Issue #305

February 1986
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73 for Radio Amateurs

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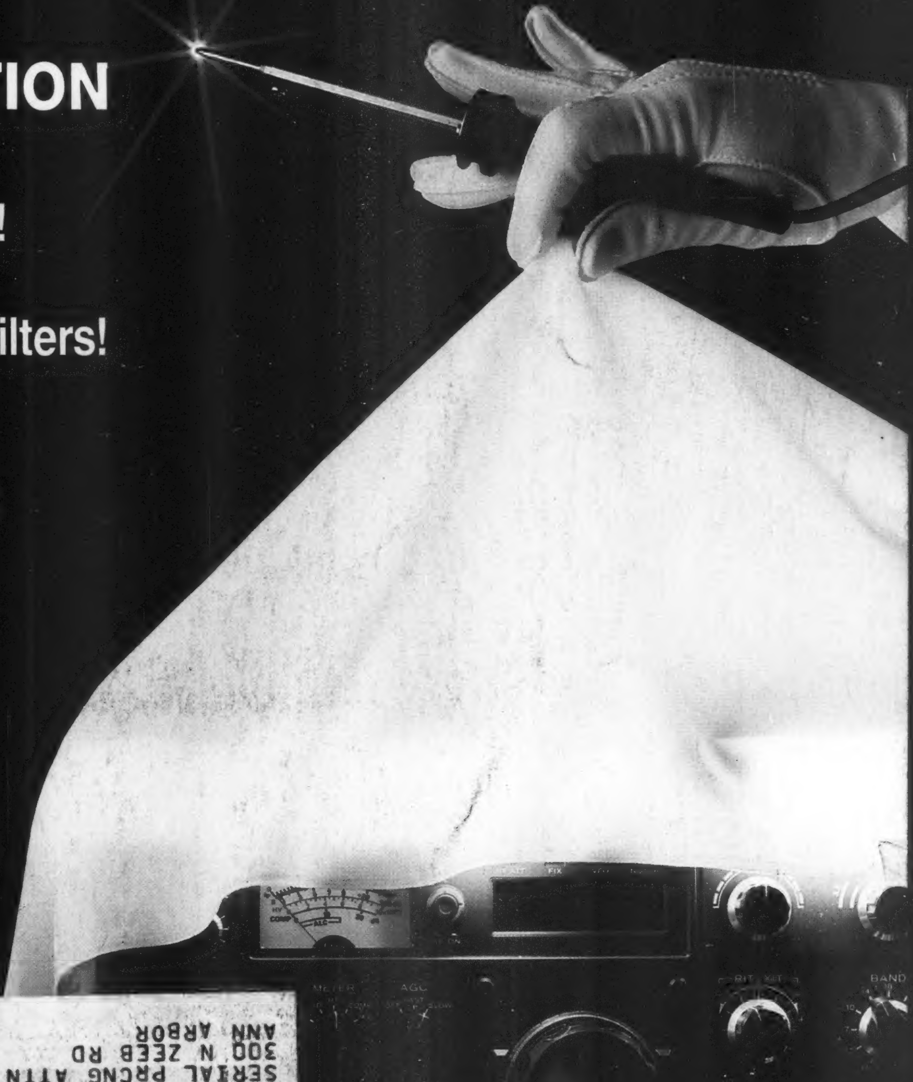

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IC-02AT

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IC-2AT

IC-02AT

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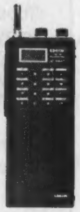

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- Patch performance should not be dependent on the T/R speed of your radio.
- Your patch should sound just like your home phone.
- There should not be any sampling noises to distract you and rob important syllables. The best phone patches do not use the cheap sampling method. (Did you know that the competition uses VOX rather than sampling in their $1000 commercial model?)
- A patch should disconnect automatically if the number dialed is busy.
- A patch should be flexible. You should be able to use it simplex, repeater aided simp or semi-duplex.
- A patch should allow you to manually connect any mobile or HT on your local repeater to the phone system for a fully automatic conversation. Someone may need to report an emergency!
- A patch should not become erratic when the mobile is noisy.
- You should be able to use a power amplifier on your base to extend range.
- You should be able to connect a patch to the MIC and EXT. speaker jack of your radio for a quick and effortless interface.
- You should be able to connect a patch to three points inside your radio (VOL high side, PTT, MIC) so that the patch does not interfere with the use of the radio and the VOL. and SQ. settings do not affect the patch.
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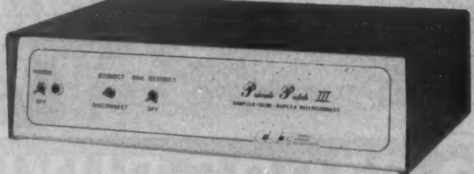

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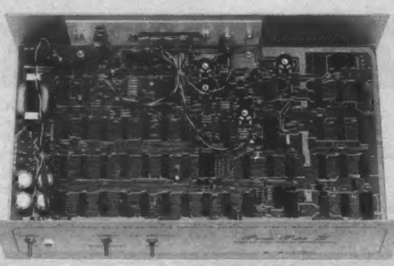

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WHAT?

News from W1XU

As I write, Halley's Comet has recently made its once-in-a-lifetime reappearance in the night sky, and a lot of extra attention by astronomers, photographers, and even the man in the street is being focused on the heavens to catch a glimpse of this infrequent visitor to our solar system. It seems appropriate, therefore, to talk a little about the solar system and its relationship to amateur radio.

Hams aren't strangers to the space surrounding the sun and planets, for we've bounced signals off the moon, relayed messages by satellite, and propagated radio waves through Earth's ionosphere. For years we've known about the sunspot cycle and its effect on radio propagation at high frequencies, and we've been able to calculate seasonal and daily variations in the MUF which affect the likelihood of one band or another being open between two locations on Earth. Although necessary, such information is by no means sufficient, because it does not take into account the day-by-day condition of Earth's magnetic field which so drastically influences our ability to communicate.

The late John Nelson, who prepared propagation forecasts for *73* for so many years, was among the first to suspect (and finally utilize) the surprising influence of planetary positions on propagation to make his astonishingly 80%-accurate predictions. Because Earth is bathed by solar radiation and, in fact, can be considered to be within the solarsphere, ionospheric propagation on Earth is complicated by the extremely variable and often unpredictable nature of the sun, whose nuances of behavior have such a powerful effect on communications. Sunspots, solar flares, coronal holes, and other major events on the sun have long been associated with radio propagation and, in recent years, have been reported regularly by the Space Environment Services Center of Boulder, Colorado, in its weekly report, *Preliminary Report and Forecast of Solar Geophysical Data*. This magnificent and extremely valuable publication is available to anyone for the asking; it catalogs hourly solar events over a period of days. You can find such phenomena as 2800-MHz solar flux, sunspot count, A and K magnetic indexes, flares, and other information of vital interest to radio communicators.

For the past eight years I have kept almost daily records of solar events on a chart which also includes the planetary alignments. Not long after I began recording, I noticed that certain alignments seemed to have a marked effect on propagation. In particular, sharp fluctuations and sudden jumps in the magnetic-field index appeared to be associated with specific alignments, particularly quadratures and inferior/superior conjunctions between some of the planets and the sun. Of even greater interest because of its implications, there seemed to be a relationship between the position of the planets and major or catastrophic events on Earth such as volcanic eruptions, earthquakes, and even hurricanes. Now, I use charts prepared several months in advance to produce the monthly propagation forecasts in *73*.

I feel obliged, in all honesty, to remark that I have not proved anything, although I think I have found some interesting and potentially important correlations. There is no consensus among observers and scientists about planetary influences; in fact, most pooh-pooh them. Nevertheless, it seems possible to me that the planets may "modulate" the sun's electromagnetic field in a manner similar to the moon "modulating" Earth's gravitational field and affecting the tides.

Perhaps it would be of interest to follow an example of the charting process from which I make the predictions. Using *The Astronomical Almanac* (available from the US Government Printing Office), I make a simple graph which has degrees on its horizontal baseline and days of the month along its vertical left margin. The degrees run from 0–90, 90–180, 180–270, and 270–360, with each 90-degree range lying exactly underneath its neighbor. In this way I can obtain quadratures (90-degree relationships), inferior conjunctions (180-degree relationships), and superior conjunctions (0-degree relationships). I then read the position of each planet from the *Almanac* and plot its location in heliocentric degrees along the baseline for the first day of the month and along the top line for the last day of the month. It is then a simple matter to connect these locations with a straight line. Where planetary position lines cross one another, there is an alignment, and their angular relationship is obvious.

Next, I take the day of each alignment and place it on another (master) chart as a vertical line according to the day on which it will occur. The days run along the abscissa on this chart, with ordinates representing values of solar flux, magnetic-field index, and the like. The master chart is then filled in with the data as the information becomes available from WWV or from the previously-mentioned *Solar Geophysical Data*. I plot the dates of moon perigee and full moon as well. After several weeks of plotting the data points and connecting them with the various colored lines, one can see relationships between solar (and Earth) events as they coincide with the planetary alignments. I have to admit that much of this can be (and probably has been) computerized to reduce the amount of time required to prepare the charts.

The chart becomes a running record of events versus planetary positions, and it is fun to see the relationships develop with time. For example, the eruption of the volcano in Colombia on November 13th coincided with a 90-degree alignment of Earth and Jupiter, an inferior conjunction of Earth and Mercury, a 90-degree alignment of Mercury and Uranus, and a 90-degree alignment of Mars and Uranus. Interestingly, the sunspot count jumped from zero on the 3rd to 50 on the 13th and

Continued on page 69

MPA

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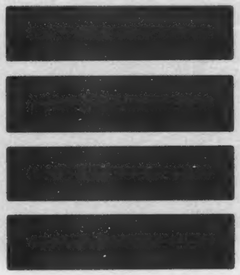

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KENWOOD

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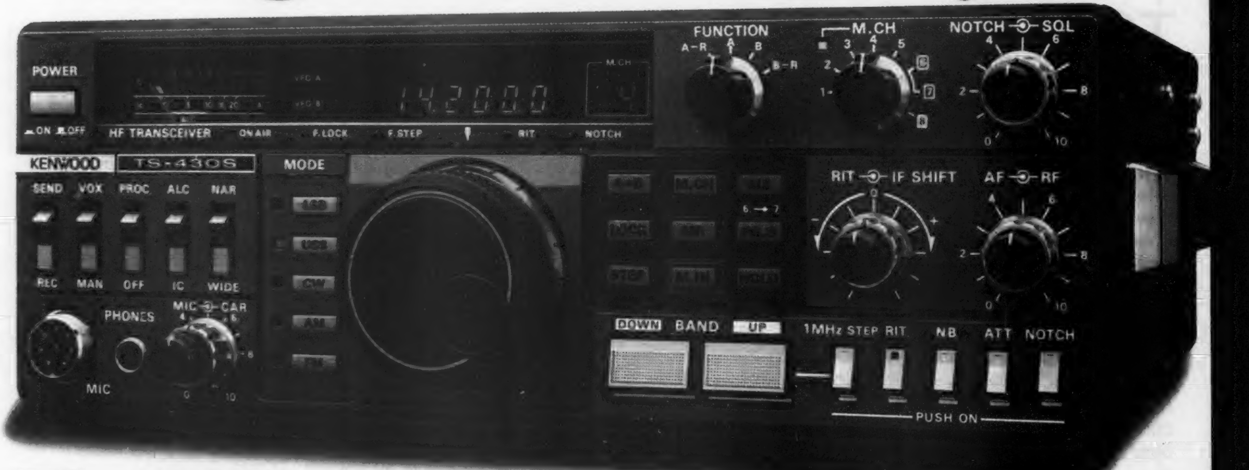
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TS-430S

Digital DX-terity—that outstanding attribute built into every Kenwood TS-430S lets you QSY from band to band, frequency to frequency and mode to mode with the speed and ease that will help you earn that dominant DX position from the shack or from the mobile!

- **Covers all Amateur bands**
  160 through 10 meters, as well as the new 30, 17, and 12 meter WARC bands. High dynamic range, general coverage receiver tunes from 150 kHz to 30 MHz. Easily modified for HF MARS operation.
- **Superb interference reduction**
  Eliminate QRM with the IF shift and tuneable notch filter. A noise blanker supresses ignition noise. Squelch, RF attenuator, and RIT are also provided. Optional IF filters may be added for optimum interference reduction.
- **Reliable, all solid state design.**
  Solid state design permits input power of 250 watts PEP on SSB, 200 watts DC on CW, 120 watts on FM (optional), or 60 watts on AM. Final amplifier protection circuits and a cooling fan are built-in.
- **Memory channels.**
  Eight memory channels store frequency, mode and band data. Channel 8 may be programmed for split-frequency operation. A front panel switch allows each memory channel to operate as an independent VFO or as a fixed frequency. A lithium battery backs up stored information.
- **Programmable, multi-function scan.**
- **Speech processor built-in.**
- **Dual digital VFOs.**
- **VOX circuit, plus semi break-in with sidetone.**

Optional accessories:
• PS-430 compact AC power supply • SP-430 external speaker • MB-430 mobile mounting bracket • AT-130 compact antenna tuner covers 80-10 meters, incl. WARC bands • AT-250 automatic antenna tuner covers 160-10 meters, incl. WARC bands • TL-922A 2 kW PEP linear amplifier • FM-430 FM unit • YK-88C (500 Hz) or YK-88CN (270 Hz) CW filters • YK-88SN (1.8 kHz) narrow SSB filter • YK-88A (6 kHz) AM filter • MC-42S UP/DOWN hand mic. • MC-60A/80/85 deluxe desk mics. • SW-2000/200A SWR/power meters • SW-100A SWR/power/ volt meter • PC-1A phone patch • HS-4, HS-5, HS-6, HS-7 headphones

25th Anniversary

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Complete service manuals are available for all Trio-Kenwood transceivers and most accessories. Specifications and prices are subject to change without notice or obligation.

QRX. . .

EDITED BY PERRY DONHAM KW1O

New Sats

THIS MONTH should see the launch of two new Soviet amateur satellites, RS-9 and RS-10. Both will be in orbits similar to the current set of RS satellites, with a period of about 2 hours. RS-9 will carry only a Mode A transponder (2m up, 10m down). RS-10 will have three transponders: Mode A, Mode K (15m up, 10m down), and Mode T (15m up, 2m down). The 2m beacon will be at 145.557 MHz. Also expected is the ejection of ISKRA-4 from the space station Salyut-7; the satellite will carry a Mode K transponder and will circle the earth every 92 minutes for just a few months.

Ham Stats

THE LATEST FIGURES released by the International Amateur Radio Union (IARU) concerning the number of licensed amateurs in the world are very interesting. In order of ham population, the top ten countries are: Japan (no surprise there!), the United States, the USSR, Brazil, the United Kingdom, the Federal Republic of Germany, Italy, Spain, Argentina, and Canada. I was really *amazed* that Yugoslavia or Czechoslovakia wasn't right up there—seems like every time I tune across 20 meters the band is just *full* of OKs and YUs! When ranked by the number of hams who are members of their national society, the list looks like this: the Federal Republic of Germany on top with 77%, the United Kingdom in second place with 51%, Spain right on the UK's heels with 50%, Italy with 37%, and the United States in fifth place with only 27%. All told there are 1,511,000 amateur-radio operators in the world.

Waivers Waived

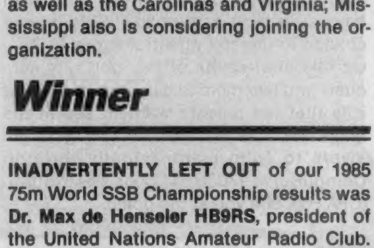
THE FCC HAS DENIED two requests for waivers of the rules covering volunteer examinations. **Jim Gustafson 5Z4JD** asked permission to conduct an exam session with one Advanced- and two Extra-class hams (the rules require three Extras). In denying the petition, the Commission said, "To establish such a precedent by waiving the requirement could easily lead to many similar requests, all of which would attempt to show a unique circumstance which would tend to make compliance with the three-VE requirement a hardship." (Ever notice how it takes the FCC a full paragraph to say, "No"?) **John Mulville KA0TNS** filed the other request. He asked for a waiver of the 13-wpm Morse test, citing a medical condition that would impair his ability to copy code. Said the Commission, "That requirement is so basic to the Amateur Service that waivers of it *are not granted*."

AL Together Now

COMPLAINING THAT, "Alabama has been made an island," repeater owners in that state have petitioned the **Carolina Virginia Repeater Association (CVRA)** for membership. Several months ago the Alabama Repeater Council directed all repeater owners to move immediately to a 20-kHz-spacing plan or lose their coordinated status ("QRX," June, 1985), even though surrounding states use a 15-kHz plan. Now the owners want to be coordinated on a regional rather than state basis, and are forming what will be the Alabama district of the CVRA. If the CVRA approves the petition, a thorough survey will be taken of all repeater operators in the state to determine whether or not a move back to 15-kHz spacing will be made. The CVRA coordinates repeaters in Georgia and Tennessee as well as the Carolinas and Virginia; Mississippi also is considering joining the organization.

Winner

INADVERTENTLY LEFT OUT of our 1985 75m World SSB Championship results was **Dr. Max de Henseler HB9RS**, president of the United Nations Amateur Radio Club. Max piloted **4U1UN** to a Class A Single-Op win with 520 QSO points and 22 multipliers for a total of 11,440 points. Max will receive a certificate for being the top scorer in his country (in fact, 4U1UN is the *only* station in that country. . .a guaranteed win!). By the way, if you contacted any two of the three UN "countries" last year, you are eligible for the **United Nations at 40 Award.** (The three calls are 4U1UN United Nations Headquarters, 4U1ITU Geneva, and 4U1VIC Vienna.) Drop a note to any of the three at its *Callbook* address.



The shack at 4U1UN.

DXCC + 1?

SPEAKING OF single-station countries, why not add the Council of European Headquarters in Strasbourg, France? Gus Browning, in his *DX'ers Magazine*, says that the station will have extraterritorial status, just like all of the United Nations buildings. Look for the prefix **TP21**—I'm sure the DXCC desk will be eager to add a "new one." Gus also mentions that VK3SX is looking for just a few more states to complete WAS on 40m: Arkansas, Delaware, Hawaii, Idaho, Nebraska, Nevada, New York(!), North Dakota, Oklahoma, Oregon, and West Virginia. Want to help him out? Drop a line to Bob Robinson VK3SX, 81 Bishop St., Yarraville 3013, Melbourne, Australia.

AM Appeal

THE US COURT OF APPEALS has upheld a decision by the FCC which sets the maximum amateur output power at 1500 Watts PEP. **Glenn Baxter K1MAN** fought the rule in court, claiming that it would adversely affect double-sideband operation by halving the maximum output (currently it is 3,000 Watts—the Commission has postponed the implementation of the 1500-Watt rule for DSB until 1990). Baxter can now appeal his case only to the US Supreme Court.

Opening

73 MAGAZINE has an opening on the editorial staff for a Technical Editor. If you are interested in living and working in the tax-free hills of New Hampshire, send your resume to *73* Magazine, Editorial Offices, 80 Pine Street, Peterborough NH 03458, Attn: Jack Burnett.

OSCAR Orbits

PROJECT OSCAR has prepared a complete set of orbital predictions for 1986. The tables list the time and longitude for all north-to-south equatorial crossings of RS-5, RS-7, and the two University of Surrey satellites (OSCAR 9 and OSCAR 11). Also, the time, sub-satellite latitude and longitude, and argument of perigee are given for the apogee of each orbit of AMSAT-OSCAR 10. Project OSCAR also has prepared *The AMSAT Phase III Satellite Operations Manual*, a 110-page book covering operating procedures and technical details of the new series of OSCAR satellites. The orbital listings are available for a $10.00 donation and the manual for a $15.00 donation: Send your orders to Project OSCAR, Inc., PO Box 1136, Los Altos CA 94023.

QSL Liberty

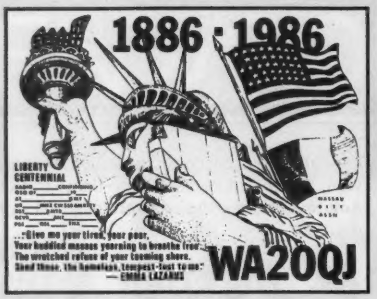
THE FIRST ENTRANT I've seen in the Statue-of-Liberty-Centennial-QSL department is a really nice one from **Al La Vorgna WA2OQJ**. Al's card is 8″ × 10″; and you can get one by working WA2OQJ any time during 1986. Al says that he is RTTY-active on both 20m and 2m and also is on packet. Anyone else issuing a commemorative card this year? Let me know!

MetroSat

WHOEVER IT WAS that came up with the name "Amateur Radio" must be doing some double takes these days—our hobby is far from amateur! And just when you thought packet radio was the hottest item on the ham menu, along comes the **Metroplex Network**. The Network is a satellite-based news system designed expressly for amateur radio. Three programs, co-produced by Metroplex and Westlink Radio, are now being transmitted: a weekly news show, a weekly swap-and-shop service, and three North American Teleconference Radio Nets per year. Affiliated club stations can downlink the shows from a commercial satellite transponder for a fee, receive them via a UHF link, or connect to the network over the telephone. A new package is available every Monday night at 10:00 pm EST. Alex Magosci WB2MGB can give you more details about network affiliation—get in touch with him at the Metroplex Network, PO Box 237, Leonia NJ 07605, or call (201)-592-7614 for a taped message.

On The Table

YOUR CHANCE to get a real picture of Comet Halley taken from a real observatory by a real astronomer is coming up this month. **Jim Young WB6FNI**, resident astronomer at the Jet Propulsion Laboratory's Table Mountain Observatory, will commemorate the celebrated slushball by operating from Table Mountain during February and March, 1986. Jim says that this will be a forty-meter-only affair and will be done on a noninterference basis with normal observatory activities. Frequencies (in MHz), modes, and times (in UTC) are: 7.120 CW 0400–0500, 7.228/7.077 SSB (split for DX to Europe and Africa) 0500–0600, 7.249 SSB 0600–0700, 7.249 SSB (on the Triple-H Net) 0700–0800, 7.228 SSB (looking for South Pacific, Australian, and New Zealand stations) 0800–0900, and 7.228/7.084 SSB (split for DX to Asia and the Far East) 0900–1000. Jim will answer your QSL with a certificate and an original Halley's Comet photo taken from the Table Mountain Observatory. Send your card and a #10 SASE (with 40¢ postage) or 5 IRCs to Jim Young WB6FNI, PO Box 576, Wrightwood CA 92397.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LIBERTY CENTENNIAL
..."Give me your tired, your poor,
Your huddled masses yearning to breathe free.
The wretched refuse of your teeming shore.
Send these, the homeless, tempest-tost to me."
— EMMA LAZARUS
NASSAU RTTY ASSN
WA2OQJ

Al WA2OQJ's commemorative QSL.

Pollish Hams

OUR 6TH ANNUAL "Fun!" poll is here! Conducted by columnist **John Edwards KI2U**, this year's survey probes the collective psyche of ham radio with questions such as, "Should hams be subject to periodic retesting?" and, "Do you think nets have a place in ham radio?" This is your chance to directly effect changes in *73*—we take the results of this poll very seriously and use them to determine just what it is that our readers want to see in the magazine. This year, you can send your answers to John electronically through CompuServe (70007,412) or The Source (CPA117). See you at the polls!

Write On!

HAVE YOU EVER read an article in *73* and said to yourself, "Gee, I could do that!"? You're right—you could. In fact, we're *asking* you to write an article for us! And, as a special bonus for "QRX" readers, I'll give you a few inside tips that will help sell your manuscript. First, pick a topic that hasn't been beaten to death already. For example, a logging program for your computer probably will not make the grade. Statistically, the most-accepted topics are antenna construction and modifications. Second, include plenty of photographs—a good picture can sometimes sell an otherwise dull article. Include captions for your shots on a separate sheet, and lightly, with a pencil, mark the back of each print with a letter or number. Third, be yourself. Just write down your ideas as you would say them to someone standing in the room with you—long words and complicated phrases just make a manuscript hard to understand. Finally, if you can't come up with an article, try writing a review. It doesn't have to be a component-by-component engineering analysis, just a summary of what you liked and disliked about the product. Again, take plenty of pictures. If you want a step-by-step guide to becoming a *73* author, send an SASE to *73* Magazine, Editorial Offices, 80 Pine Street, Peterborough NH 03458, Attn: How to Write.

Think Thinkers

THE COMPUTER MUSEUM in downtown Boston, in conjunction with ComputerLand and CW Communications, is searching for relics left over from the early days of computing. They are looking for just about anything that smells of mold: kits, cards, one-of-a-kinds, and memorabilia. If your item is selected to become part of the exhibit on computer evolution, you'll receive an invitation to the grand opening and a bound copy of the exhibit catalog. If yours is one of the "fantastic five" pieces, as determined by a distinguished panel of experts, the Museum will pay your way down to Beantown (and home again) for the big opening bash. Get in touch with the Museum for an official entry form, or just mail a picture and a description of your entry to The Computer Museum, Personal Computer Competition, 300 Congress Street, Museum Wharf, Boston MA 02110; (617)-426-2800.

Packet Paper

GWYN REEDY N1BEL dropped by the office recently to tell us about a new magazine for packet-radio enthusiasts, called (appropriately) ***Packet Radio Magazine***. The magazine is an extension of the Florida Amateur Digital Communications Association's *FADCA>Beacon* (a *73* Newsletter of the Month winner) and will be distributed nationwide. Space will be made available in each issue for local clubs to use; Gwyn says that this arrangement will let local groups use *Packet Radio* as their club "newsletter" and will also keep packet organizations around the US up-to-date on each other's progress. If you or your club is interested in *Packet Radio Magazine*, get in touch with Gwyn at FADCA, Inc., 812 Childers Loop, Brandon FL 33511.

Friends

"QRX" was brought to you this month with the help of the *W5YI Report*, *Amateur Satellite Report*, the *FADCA>Beacon*, Gus Browning's *DX'ers Magazine*, and *Westlink*. Don't forget to send your news items and photographs to *73* Magazine, Editorial Offices, 80 Pine Street, Peterborough NH 03458.

KENWOOD

...pacesetter in Amateur radio

WAIT! 220 MHz Coming soon!

Power-Full...70 Watts!

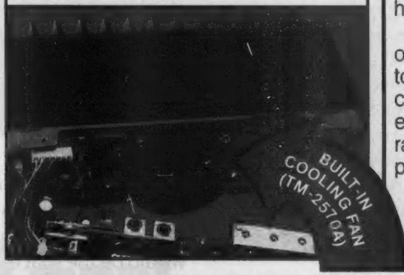
TM-2570A/2550A/2530A

Sophisticated FM transceivers

Kenwood sets the pace again! The all-new "25-Series" brings the industry's *first* compact 70-watt 2-meter FM mobile transceiver. There is even an *auto dialer* which stores 15 telephone numbers! There are three power versions to choose from: The TM-2570A 70-watt model, the TM-2550A for 45-watts, and the 25-watt TM-2530A.

- **First** 70-watt FM mobile (TM-2570A)
- **First** mobile transceiver with telephone number memory and autodialer (up to 15 telephone numbers)
- Direct keyboard entry of frequency
- Automatic repeater offset selection according to the ARRL 2-meter band plan —**a Kenwood exclusive!**
- Extended frequency coverage for MARS and CAP (142-149 MHz; 141-151 MHz modifiable)
- 23 channel memory for offset, frequency and sub-tone
- Big multi-color LCD and back-lit controls for excellent visibility
- Front panel programmable 38-tone CTCSS encoder **includes 97.4 Hz** (optional)
- 16-key DTMF pad, with audible monitor
- Center-stop tuning—**another Kenwood exclusive!**
- Frequency lock switch
- **New** 5-way adjustable mounting system
- **Unique** offset microphone connector —relieves stress on microphone cord
- HI/LOW Power switch (adjustable LOW power)
- Compact DIN size

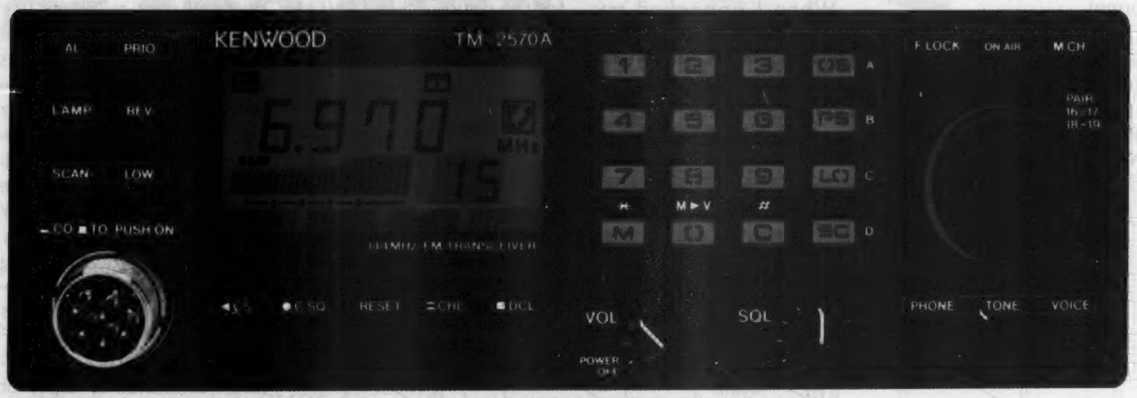
Large heatsink with built-in cooling fan (TM-2570A)



DCL Introducing... Digital Channel Link

Compatible with Kenwood's DCS (Digital Code Squelch), the DCL system enables your rig to **automatically** QSY to an open channel. Now you can automatically switch over to a simplex channel after repeater contact! Here's how it works:

The DCL system searches for an open channel, remembers it, returns to the original frequency and transmits control information to another DCL-equipped station that switches **both** radios to the open channel. Microprocessor control assures fast and reliable operation. The whole process happens in an instant!



Actual size front panel

Optional Accessories

- **TU-7** 38-tone CTCSS encoder
- **MU-1** DCL modem unit
- **VS-1** voice synthesizer
- **PG-2K** extra DC cable
- **PG-3A** DC line noise filter
- **MB-10** extra mobile bracket
- **CD-10** call sign display
- **PS-430** DC power supply for TM-2550A/2530A
- **PS-50** DC power supply for TM-2570A
- **MC-60A/MC-80/MC-85** desk mics.
- **MC-48** extra DTMF mic. with UP/DWN switch
- **MC-42S** UP/DWN mic.
- **MC-55** (8-pin) mobile mic. with time-out timer
- **SP-40** compact mobile speaker
- **SP-50** mobile speaker
- **SW-200A/SW-200B** SWR/power meters
- **SW-100A/SW-100B** compact SWR/power meters
- **SWT-1** 2m antenna turner

Complete service manuals are available for all Trio-Kenwood transceivers and most accessories. Specifications and prices are subject to change without notice or obligation.

KENWOOD

TRIO-KENWOOD COMMUNICATIONS
1111 West Walnut Street
Compton, California 90220

John L. Rehak N6HI
8701 MacAlpine Road
Garden Grove CA 92641

Razor-Sharp CW

Here's a filter for fanatics—or is 80 Hz too wide?

The Kenwood TS-430S is without doubt one of the best of the smaller mobile-size HF transceivers on the market today. With its many modes and logical memory-control operation, it is truly excellent for mobile operation. *All* of my operation is mobile. . .and CW is my preferred mode. My work as a traveling salesman requires me to spend many hours behind the wheel of my car each week, and my mobile CW operations make those hours fun instead of boring!

With my primary interest being CW, I saw only one small deficiency in the operation of the TS-430S on CW: Kenwood did not make any provision for installation of an active audio filter for improved reception. I tried their 270-Hz i-f filter, and although it is nice as i-f filters go, it is no substitute for a good narrow active audio filter. (Having both is ideal!)

I have been building and using active audio filters for CW receivers for years and have long since recognized their performance advantages. I made the decision to modify my TS-430S even before I purchased the rig.

Squeezing In a Filter

When I unpacked my brand-new rig, I gave it only a quick check to ensure that its "stock" operation was without problems before I removed the cabinet covers and started searching for an area within the rig that would have the spare room to install a good CW filter. I found several good possibilities and, for my unit, decided on the area directly under the top cover and to the left, just in front of the filter unit (X51-1290-00—see instruction manual, page 27).

This is a fine location as long as you keep the CW filter board low profile (lay resistors and "long" components down on the board; don't stand them on end). Another good possible location would be the space allocated for the optional FM-430 (FM mode unit)—if you do not have the FM unit installed and do not plan to do so.

Circuit Details

The schematic diagram of the CW filter I developed for the TS-430S is shown in Fig. 1. The circuit consists of four stages of active bandpass filtering provided by two type-uA747 integrated-circuit dual op amps and includes a simple threshold detector (diodes D1 and D2) between stages 2 and 3 to reduce low-level background noise. Each of the four filter stages acts as a narrow bandpass filter with an audio bandpass centered at 750 Hz.

The four stages together result in an excellent and extremely narrow CW filter that will pass a 750-Hz CW note with no attenuation but will reject adjacent signals so well that an audio note below 600 or above 900 Hz can barely be heard. The actual measured 3-dB bandwidth is only 80 Hz wide . . .truly a "razor sharp" CW filter!

I strongly suggest using polycarbonate or other temperature-stable capacitors for each of the eight .001-uF capacitors, with a capacitance tolerance of ±5% or less, to ensure that each of the four stages of filtering will be correctly tuned to identical bandpass frequencies. If you are a real calibration fanatic, you can tweak the bandpass frequencies of each stage by adjusting the value of its 27k resistor. (In-

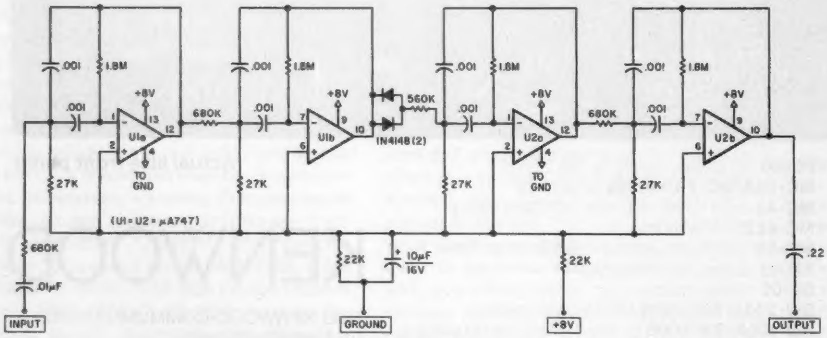


Fig. 1. Schematic diagram.

Catch of the day!

Have you been trawling the bounding main for a new product? We have just netted it—the TP-38 microprocessor controlled community repeater panel which provides the complete interface between the repeater receiver and transmitter. Scuttle individual tone cards, all 38 EIA standard CTCSS tones are included as well as time and hit accumulators, programmable timers, tone translation, and AC power supply at one low price of $595.00. The TP-38 is packed like a can of sardines with features, as a matter of fact the only additional option is a DTMF module for $59.95. This module allows complete offsite remote control of all TP-38 functions, including adding new customers or deleting poor paying ones, over the repeater receiver channel.

Other features include CMOS circuitry for low power consumption, non-volatile memory to retain programming if power loss occurs, immunity to falsing, programmable security code and much more. The TP-38 is backed by our legendary 1 year warranty and is shipped fresh daily. Why not set passage for the abundant waters of Communications Specialists and cast your nets for a TP-38 or other fine catch.

$595.00 each

$59.95 DTMF module

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creasing the resistance will lower the bandpass frequency.) In actual practice, you will probably find that the four stages don't really have to be *perfect*...just close enough so that all four stages will pass the desired audio frequency of 750 Hz.

I constructed my filter on a small piece of perfboard, with components on one side of the board and small-gauge insulated wires forming all interconnections on the reverse side.

Initial Checkout

After completing the circuit construction, it would be a good idea to verify the circuit's operation before installation in your TS-430S. Using a 9-volt battery for power, connect the filter input to the rig's headphone output and listen to the filter output with high-impedance headphones, tuning across a carrier or CW signal to ensure that the filter passes a clean sounding signal at about 750 Hz but rejects it when you tune higher or lower. If all has gone well so far, you are undoubtedly very impressed with this filter and your handicraft by now, and you *may* elect to stop right there and use the filter board with the nine-volt battery. Feel free to quit here and build the filter into a small box to use as is with any rig and headphones, if you like.

Installation

Like me, you will probably prefer to build this filter right into the TS-430S since this saves having to carry an extra box with you and allows the great convenience of a feature which can be switched in and out as needed and will drive the TS-430S speaker as well as headphones.

The installation I will describe is simple and will end up with the filter operating as if Kenwood had designed it in yet will allow you to easily "un-modify" the rig at any time in the future if you want to sell it "stock" and keep your super little filter to install in a *new* rig.

The filter, as I installed it, will modify the operation of the front-panel ALC/IC meter switch so that it becomes your new audio filter in/out switch. I elected to use this switch (leaving the transmit meter permanently in the IC mode) because I never use the ALC position anyway. This is a very small price to pay to have the CW filter switch in the ideal position!

You may prefer to use something else, such as the noise blanker switch, or whatever, but using an existing switch means you won't have to drill any holes in that beautiful front panel to mount a new one.

For the actual circuit-board mounting, I took the easy way out. Rather than drilling holes, I just enclosed the circuit in a small plastic bag with the four interconnecting leads coming out one corner and let the whole assembly float in the left-rear corner of the rig. It is confined in its location by nearby components yet can't possibly short to anything through the plastic.

Here is the installation procedure for the TS-430S in 5 easy steps:

(1) Unplug connector 4 on the i-f board. Connect Ground from the filter board to pin 2 on connector 4. Remove pin 4 from connector 4 and connect *board pin* 4 to a long insulated wire *and* to Input on the filter circuit.

(2) Unplug connector 14 on the i-f board and connect:
—connector 14 pin 1 to the long insulated wire you connected in step 1
—connector 14 pin 2 to connector 4 pin 4
—connector 14 pin 3 to Output of filter circuit

(3) Connect +8 volts from the filter circuit to pin 3 of connector 7 on the i-f board.

(4) Disconnect blue wire from the (+) side of the S-meter, tape over the wire end so it will not short to anything, and tuck into nearby wiring.

(5) Connect an insulated wire from the S-meter (+) connector to i-f board connector 14, board pins 2 and 3. This completes the installation.

Note: In the TS-430S instruction manual, i-f board connector 14, *in the i-f board schematic*, IC is shown incorrectly as being on pin 1. It should be pin 3—as is correctly shown on the *main schematic* in the manual.

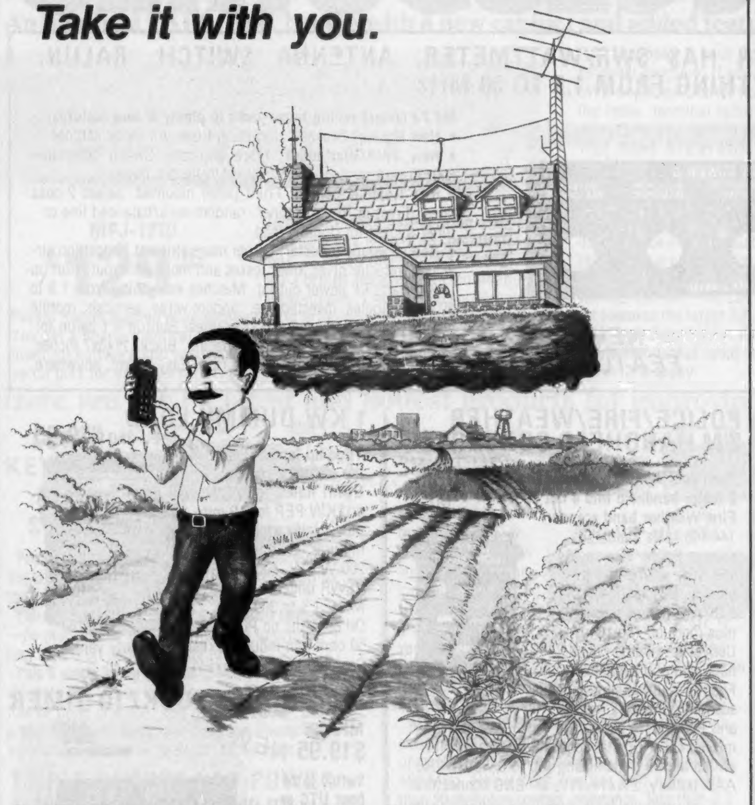
Operation

If you are not now used to operating CW with a filter such as this one, you may find that you will need to change your operating style just a bit. This filter is so narrow that if you tune rapidly across the band with the filter switched in, you will completely miss some signals.

In my normal operating practice, I tune through the band with the filter switched out, then switch it in when I want to really focus in on a particular CW signal. Once that signal is in your filter, you can hit the frequency-lock button on your TS-430S and you really are locked on that station. As long as he does not have a frequency drift on his signal, you will not have to touch your rig again, and you will most likely never hear any other stations during your entire QSO unless you elect to switch the filter out to see what is happening around your frequency.

This modification has certainly increased my enjoyment of CW operating, and I'm sure you will find that having a filter like this in your TS-430S will encourage you to operate a lot more CW. If you also install the optional Kenwood narrow i-f filter (270 Hz), the winning combination will offer CW selectivity second to none! ■

Take it with you.



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Exchange electronic mailbox messages with your family – like "I'll be late", or "All is OK". Or talk with your family directly through *ShackPatch*™, with you in remote control of your home station. Report traffic accidents or disabled motorists through your home phone while mobile or portable with *PersonalPatch*™.

All the power of your home station (and more) really can follow you anywhere… to find out more about ShackMaster™ just write, send us your QSL, or call and talk with us at 408-749-8330.

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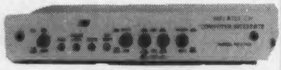

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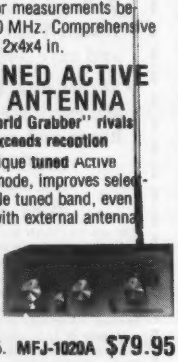

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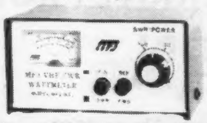

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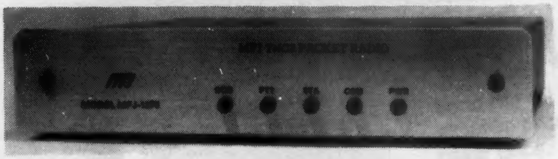

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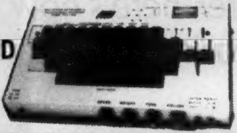

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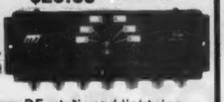

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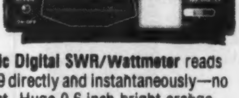

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New Bands for Old Rigs

Internal or external, converter or transverter, here's how to add three WARC bands to your favorite radio.

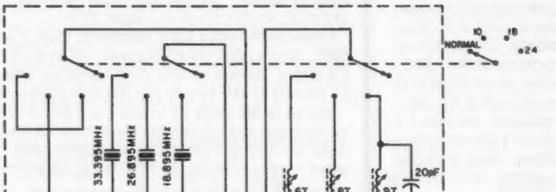

Fig. 1. Modified hfo circuit of the HW-101. Third-overtone crystals are used, inductances wound on 7mm formers with turns spaced the diameter of the wire.

Charles Bryant GW3SB/C3SB
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England

With the 10-MHz band in worldwide use and more countries coming on 18 and 24 MHz each week, now is the time to think seriously about getting started on the WARC bands—if you haven't already done so!

The easiest way is to buy a new rig, and many amateurs are doing just this, with the result that there are some very good five-band rigs on the market at reasonable prices. However, it is not too difficult to find a way of modifying an existing five-band rig to cover eight bands. There are at least three methods of doing so, and this article reviews the advantages—and the snags.

Internal Modification

The most elegant method is to make an internal modification, but this is usually quite difficult. If your rig is a transceiver with provision for the reception of WWV on 10 MHz, it is not too hard to change the connections to allow transmission also. Many owners of popular rigs, such as the FT-101 series, have done so. However, some rigs provide for reception of WWV on another frequency, and these rigs are not so easily changed.

It may be thought that with the low sunspot count, the whole of the 28-MHz band is not required and some of these circuits can be changed. This looks attractive *provided* that the switching arrangements allow. I have found that most rigs use a single set of inductors in some circuits for the whole of the 28-MHz band. The alterations would therefore be extremely complicated, and a different approach would be much easier.

Although I have not tried it myself, the modification of the Heath HW-8 should be fairly simple. Because band changing is accom-

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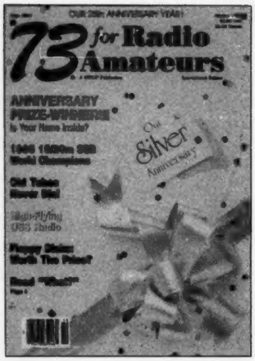
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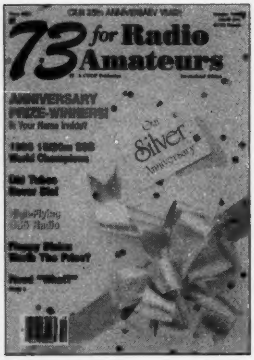
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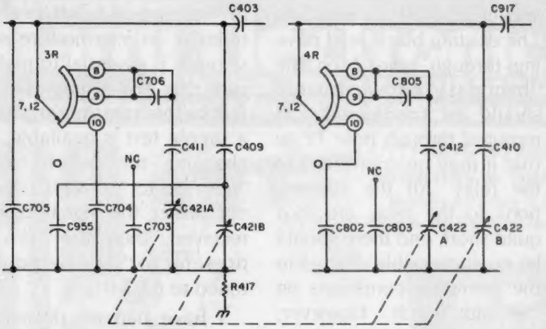


Fig. 2(a). Tuned circuits (inductors omitted) of driver input and output before modification.

plished by push-button on/off switches combined with diodes, all circuits can be isolated effectively when all the bandswitches are in the off position. Three more complete circuits can be constructed and mounted on a board fixed about ½″ below the existing PCB. Each separate circuit should be positioned as close as possible beneath the corresponding one on the PCB. It may be necessary to make the cabinet a little deeper and, of course, it will be necessary to add three new switches with their associated diodes. Incidentally, the same arrangement could be used to add the 1.8-MHz band to this popular QRP rig.

Converter—Transverter

If you use a separate receiver (or are prepared to use your existing transceiver in the receive mode only) the use of a converter in front of the rig is the obvious method. Circuits for converters are common. LA8AK (in *Radio Communication*, May, 1983, page 427) and DL1ZB (in *SPRAT*, Summer, 1983, pages 9–11) have suggested that by using a single 4-MHz crystal, the 10- and 18-MHz bands are covered with the main receiver tuned to 14 MHz, and the 24-MHz band can be found with the receiver tuned to 28 MHz.

At least for the CW operator, it may prove easier to build a simple CW transmitter for use with the main rig, plus a converter.

There is no reason why a transverter should not be used. For QRP operators this course is possible and circuits have been published. As transverters are really practicable only at low power, this method is likely to appeal only to the QRP fraternity (the circuits I have seen have all been designed for a power of 10 W or under).

External modification

This is the method I have used and which will, in most instances, prove to be the easiest approach. The modification consists of breaking the connections from the crystal and tuned-circuit switches of the hfo and inserting a small changeover relay to allow either the existing circuits or new ones, contained in a small external screened box, to be connected to the oscillator. If the rig has a source of 12 V dc, there is no difficulty in providing excitation for this

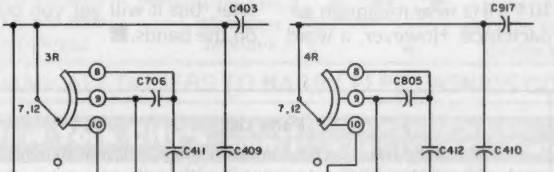
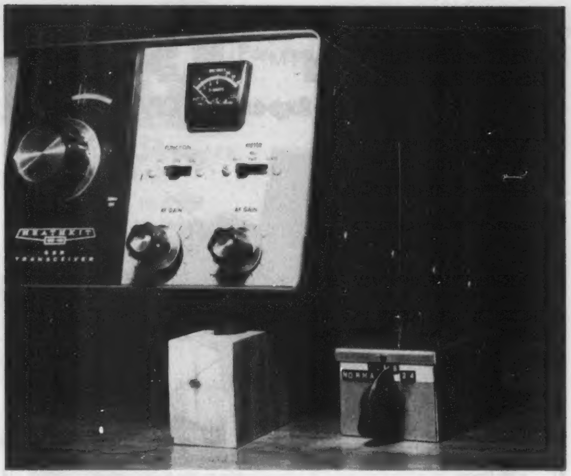
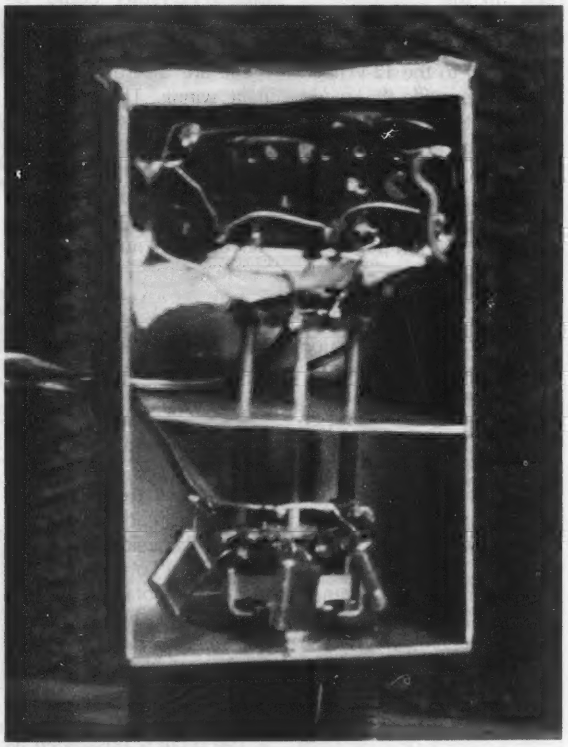


Fig. 2(b). Tuned circuits (inductors omitted) of driver input and output after modification to enable 7 and 10 MHz to be tuned with one inductor.



The new hfo circuits and switch are in the small box to the right of the HW-101.



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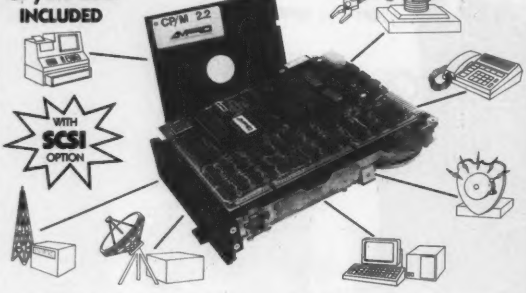

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relay. In the case of older rigs, a couple of diodes and a 100-uF capacitor can be connected to the 12-V heater line to provide the necessary dc. It does not matter whether the positive or negative line is connected to ground.

In *Radio Communication* for April, 1982, on page 317, I described my modification of the Heath HW-101 to include the three new bands. This is an expanded version of my original proposals. One advantage of this modification is that it does not involve any mutilation of the equipment, which can, if necessary, be restored to its original form.

The new bandswitch, with associated components, is assembled in a small screened box with an internal screen between the wafers. The size of this box depends on the size of the switch. I used wire-ended crystals which were soldered directly onto the switch, but sockets and plug-in crystals could be used if desired. The components in the other compartment are all supported by their wiring. The simplicity of the circuit is shown in Fig. 1, where component values are placed against *new* components and the existing components are shown with the reference numbers given by Heath.

The leads from the screened box to the rig should be as short as possible. The lead to the tuned circuit must be of miniature coax, but the lead in the crystal circuit and the relay lead may both be unscreened. Originally, I used coax for the crystal lead, but the additional capacitance caused difficulties. To avoid drilling the cabinet of the HW-101, the leads may be fed through the ventilation holes in the bottom of the cabinet. In operation, the box is placed alongside the HW-101.

The relay is positioned as near to the underside of the socket of V19 as possible. The existing black lead passing through hole Z on the "bandpass circuit board" should be unsoldered and rerouted through hole TP so that it may be connected to the relay. All the connections to the relay are thus quite short, and there should be no appreciable change to the operating conditions on the old bands. However, some realignment is necessary before the new bands can be tuned.

By juggling with the slugs in both sets of driver coils (L705, L704, L703, L702, L805, L804, L803, and L802), it is possible to tune to 24 MHz with the "driver preselector" near maximum capacitance and 28 MHz with the capacitor near minimum. Similarly, 18 and 21 MHz can be covered together without any difficulty. A problem arises on 7 and 10 MHz because the capacitance swing is insufficient to cover both bands. The solution to this problem lies in disconnecting C703 from contact 9 of wafer 3R on the "driver grid switchboard" and joining contact 9 to contact 8. Similarly, C803 should be disconnected from contact 9 of wafer 4R on the "driver plate switchboard," and contact 9 should be joined to contact 8. Although this sounds very difficult, a glance at Figs. 2(a) and 2(b) will explain what is involved.

These modifications allow 7 MHz to be tuned near maximum capacitance and 10.1 MHz near minimum capacitance. However, a word of warning: *8.6 MHz also tunes at an intermediate position*. It is essential to make sure that the tuning is correct before transmitting, and a simple test is available. If changing the switch from "normal" to "10 MHz" does *not* affect the signal being received, then the "driver preselector" is wrongly tuned to 8.6 MHz.

I have had no difficulty since making the original modification in 1981, and the performance on the old bands (except the high part of 28 MHz) has not been affected. I should, however, point out that I work exclusively on CW; there may be difficulties on SSB if the output circuit is not optimum. There is also the additional point that the tuning of 24 MHz and 28 MHz in one circuit will result in a considerable reduction of drive on the higher parts of the 28-MHz band.

I have described this modification in some detail, and owners of HW-101s should have no difficulty in duplicating my modification. Owners of other equipment may well feel encouraged to attempt a similar approach.

Antennas

Having got your rig on the new bands, there is no need to erect a new antenna in order to try it out. Use your existing 3.5-MHz dipole (trap dipoles are not recommended) or G5RV antenna. This may not be the perfect answer, but it will get you out on the bands. ■

Parts List

1—Aluminum box, 10 × 5 × 5 cm with lid and internal screen
1—3-bank, 4-position rotary switch with knob
1—18.895-MHz third-overtone crystal
1—26.895-MHz third-overtone crystal
1—33.395-MHz third-overtone crystal
3—7mm coil formers with iron cores
1—0.001-uF capacitor
1—20-pF capacitor
1—100-Ohm resistor
1—12-V operating miniature double-pole changeover relay
Miniature coax and other connecting wire

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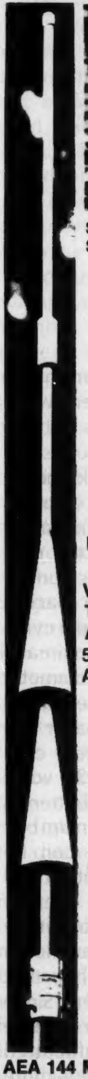

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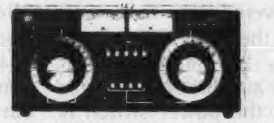

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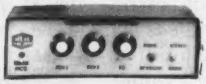

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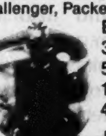

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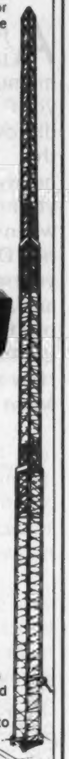

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Razzle-Dazzlin' Your Azden

Some sleight-of-hand with a fistful of parts will make your PCS-2000 a 2m star!

Are you tired of replacing the silver-oxide memory backup cells in your Azden? Have you discovered the hard way that the PCS-2000 draws nearly 20 milliamps from your automobile battery when the power switch is off? Do you sometimes find yourself wishing there was an easy way to quickly sample the repeater input frequency when receiving? How about some hang time when in the scan mode; wouldn't it be nice if the receiver would pause for a few seconds after the repeater dropped off, to allow for that slow-to-respond fellow? This article deals with all these problems and more, with some easy and reliable modifications.

Disassembling the Control Head

All the changes described in this article are made within the control head itself; no changes are made to the main radio chassis.

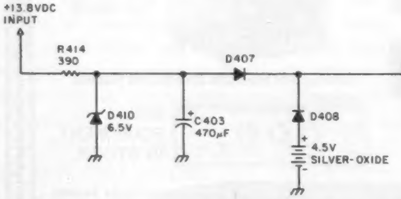

Fig. 1. Original memory-protection circuit uses three silver-oxide cells and charge-protection diode D408 to apply power to the microprocessor while the main power is off.

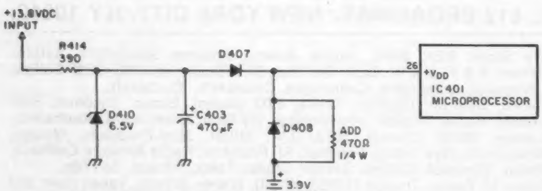

Fig. 2. Modified memory-protection circuit uses a three-cell nicad pack instead of the silver-oxide cells. Adding a 470-Ohm resistor across D408 allows the nicad pack to charge whenever the radio is operated.

Separate the control head from the main chassis. Remove the top and bottom plates; there is a single screw on each side of each panel. (Page 17 of the Azden instruction manual shows this procedure.) Now remove the four screws on the back plate; also remove the single chrome-plated screw in the right rear corner of the control board. This will allow the rear plate to dangle on the speaker-jack leads. This jack must be removed to allow room for the addition of the battery pack as described in a later paragraph. Unscrew the speaker jack from the rear plate; set the three cover plates and all the screws aside.

Adding a Nicad Battery Pack

The first change we can make is to replace those expensive little silver-oxide cells with a nickel-cadmium battery pack which is recharged every time the transceiver is used. The original circuit (Fig. 1) has diode protection (D408) for a depleted or shorted cell, but this same diode also blocks any charging current to the memory battery (we wouldn't want to try to charge the silver-oxide cells). As shown in Fig. 2, the simple addition of a resistor across D408 will allow charging current to flow into the battery when the power switch is on.

The battery pack should be a three- or four-cell pack, readily available, and small enough to fit into the confines of the Azden control head. The available space is large enough to hold a cylindrical battery approximately 3/4 of an inch in diameter and up to 2-1/8 inches long. I chose a common pager battery made of three cells (nominally rated at 3.9 volts, 140 mA hours). The battery is Motorola part number 60D83009H02 and can be obtained at any authorized Motorola Service Center (they are numerous); they should also be available from any service shop that repairs pocket pagers. Since a very large number of these batteries is manufactured each year, the price is quite reasonable; they sell for less than ten dollars each. This is just slightly more than the price of one set of consumable silver-oxide cells.

After obtaining the battery pack, a set of leads must be attached. *Do not* try to solder the leads directly to the battery. Unfortunately, this battery is not equipped with solder tabs, but with a little effort and thought, a reliable connection can be made. One way of attaching leads is to solder a small solder lug to the end of each of the two leads and then tape the lugs in place against the ends of the battery, forming a homemade battery holder. (I placed small pieces of foam rubber on top of the lugs and underneath the tape as a sort of spring to ensure a good, firm connection at all times.) The lugs should be plated rather than bare copper. This will ensure trouble-free contacts in the future. Wrap the whole assembly in tape or kraft paper to guard against short circuits; remember this pack must squeeze into a small space in close proximity to the foil side of a printed circuit board.

We must next modify the circuit of Fig. 1 to allow the battery to be charged. Locate D408; it is on the main control board just to the left of the old battery holder. Solder a 470-Ohm, ¼-Watt resistor across this diode. This should be done on the component side of the board if you plan to implement the other modifications in this article. If the leads are pre-tinned, it is quite easy to tack the resistor right onto the leads of the diode.

Finally, the battery pack must be soldered into the circuit. (If you plan to make more modifications, it will be easier if the battery is not yet attached to the control head.) Before the battery is installed in the head, it is a good idea to charge it; most nicad batteries are at least partially discharged when purchased due to their relatively short shelf life. Charge the battery by applying 12 to 14 volts through a 1000-Ohm, ¼-Watt resistor for at least ten hours. Now pre-tin the leads and the two clips on the old battery holder. Try to attach the wires slightly down the sides of the clips because there is very little clearance between the clips and the top plate when it is restored. The battery leads can be soldered to the back side of the board, but this area is best reserved for some of the following modifications. The battery fits vertically in the space directly behind the scan-mode switch.

Battery Capacity and Life

The 470-Ohm resistor in combination with the nominal 4-volt battery causes about 3.6 milliamps of charge current whenever the power switch is turned on. The memory-backup drain with the power switch off measured about 75 microamps on my radio. If we assume an average typical operating time of one hour per day (to and from work, for example), then the battery will be charged for one hour and discharged for 23 hours out of each day.

A typical nicad battery is only about sixty percent efficient when charging, so the total charge per day will be $3600 \times 0.6 \times 1 = 2160$, or about 2 milliamp/hours per day. The battery will discharge for 23 hours at about 75 microamps, thus the discharge will be $75 \times 23 = 1725$ or about 1.8 milliamp/hours per day. Thus our battery should stay charged if the radio is used an average of 45 minutes for every 24 hours that it is off. These are worst-case figures, and in reality the battery probably needs only about 30 minutes of charge per day. Also note that as the battery becomes discharged, the charge rate will increase slightly due to the increased battery terminal voltage.

With a discharge rate of 75 microamps and a battery rating of 140 mAh, we can predict how long the battery pack will protect the memory without ever being recharged (if, for example, the radio goes unused for several days). Most cylindrical nicad packs exhibit an increase in their Ampere/hour capacity when discharged at a very low rate (we qualify). This increase is in the order of thirty percent. Thus, $140{,}000 \times 1.3 = 182{,}000$ effective μAh. Dividing this by 75 microamps and 24 hours, we can predict that this battery should keep the memory happy for more than three months.

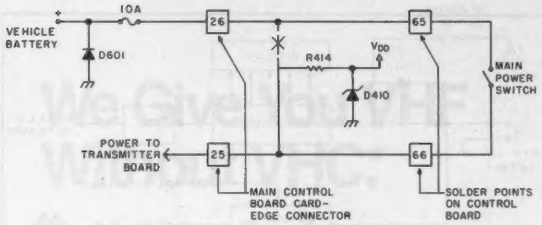
+
10A
VEHICLE BATTERY
D601
26
65
R414
V_{DD}
D410
MAIN POWER SWITCH
POWER TO TRANSMITTER BOARD
25
66
MAIN CONTROL BOARD CARD-EDGE CONNECTOR
SOLDER POINTS ON CONTROL BOARD

Fig. 3. Moving R414 to the cold side of the power switch eliminates current drain from the vehicle battery when powered off.

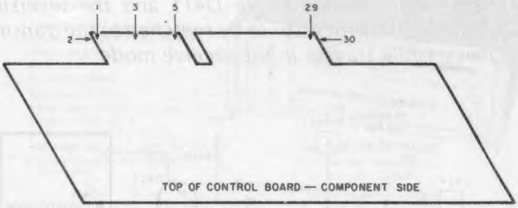

Fig. 4. Numbering sequence for control-board card-edge connector. Odd numbers are on top; even numbers are on the solder side.

The charge rate of 3.6 milliamps was chosen to be what is known as a minimum rate. This rate of charge is safe for continuous charging without harming the battery. If you wish to modify the charge rate, all that is necessary is to change the added resistor to a new value found by subtracting the battery float voltage from 5.9 volts and dividing the answer by the desired current. The 5.9 volts is the regulated Vdd found on the control board which we use to charge the battery. Be careful not to load this too heavily. A little experimenting will show quickly what is too much.

Reducing the Standby Current Drain

My Azden PCS-2000 came from the factory wired in such a way that it consumed 20 milliamperes from the primary power source even when the main power switch was off. The industry-accepted standard for mobile radios dictates a primary power connection directly to the vehicle battery. Under worst-case conditions—very cold weather, for example—it is possible that after an extended period of non-use this constant discharge could prevent a vehicle from starting. To eliminate this possibility, rewire the control processor board power as shown in Fig. 3.

This change is made very simply by moving one end of resistor R414 from main card-edge connector pin 26 to pin 25. Fig. 4 shows the proper numbering sequence of this connector. Trace pin 26 along the foil until you find R414. Lift this end of R414 from the board and tack it back down on a solder pad—about a quarter inch away—which comes from connector pin 25.

The result of this change is that standby current drain when the main power switch is off drops to an insignificant few tens of nanoamperes. This current comes from the reverse leakage in the power transistors in the rf PA module.

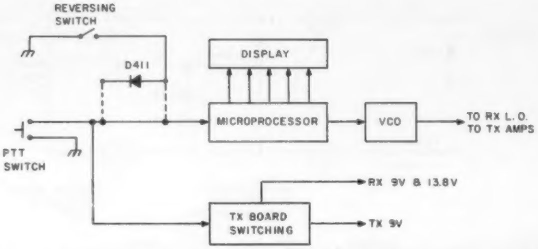

Fig. 5. Engaging the PTT switch causes the microprocessor to change the vco to the transmit frequency and causes the transmit switching to mute the receiver and turn on the transmitter. Adding diode D411 and the reversing switch allows the processor to be switched to the transmit frequency while staying in the receive mode.

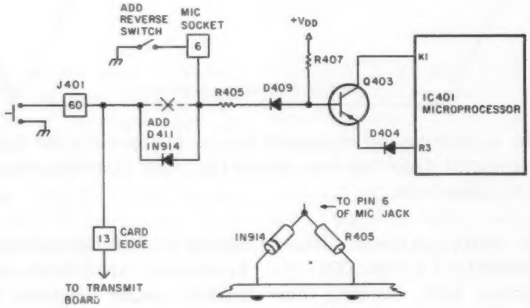

Fig. 6. Reversing switch is mounted in the microphone case. Lift one end of R405 and add D411 as shown.

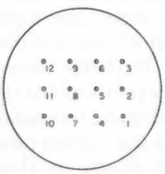

Fig. 7. Front view of the microphone jack showing the pin-numbering sequence.

Add a Reverse-Input Switch

Because of the way the microprocessor functions, it is very simple to fool the receiver into listening on the repeater's input instead of the output. Refer to Fig. 5. One of the things that happens when the microphone PTT switch is pressed is that the microprocessor reprograms the vco for transmitting on the offset frequency. This PTT signal also goes to the transmitter board to enable the transmitter and disable the receiver. The processor also changes the display to show the offset frequency. By telling the processor that we wish to transmit but at the same time witholding this information from the transmitter, the radio will receive on the transmit frequency!

With the addition of a single diode (shown in Fig. 6) and a slide switch in the microphone case, we have an instant reversing switch. I mounted my switch in the space vacated by the remote squelch control. The loss of this external squelch pot was not a problem since it was never used anyway.

Separate the microphone case by removing the four screws in the back piece. Remove the squelch knob and potentiometer from the microphone case. (For those of you who have purchased the old-style Azden DTMF tone microphone option, the knob will be missing already.) There are two red wires and one slate (gray) wire attached to the squelch pot. The reds are common (ground) and will be attached to one side of the new slide switch; the slate wire goes to the other side of the switch. The physical mounting of the switch is made simple by the use of quick-setting epoxy glue. Larger switches make necessary the removal of the mounting posts that held the squelch pot. Choose a switch whose slide arm doesn't stick through the case too far and whose action is stiff enough to preclude accidental operation when handling the microphone. Reassemble the microphone, being careful not to pinch any of the tiny wires.

At the control head, locate R405 (all the parts on this board are well labeled with white silkscreening). Find the end that connects to the cathode of D409. Unsolder *the other end* of R405 and lift it off the board. Insert the cathode end of a new diode, a 1N914, into the board where R405 was. Twist together the anode end of the new diode and the free end of R405. Connect to this junction a four-inch piece of insulated wire. Turn the control head onto its face and find the board holding all the potentiometers and switches.

Locate a large electrolytic and a 22-Ohm resistor. On the solder side of the board, about ¾ of an inch below the 22-Ohm resistor (towards the LEDs), there should be a pink wire coming from pin 6 of the microphone socket. Lift the board end of this wire and connect it to the four-inch length of wire coming from the new diode. Insulate the splice. See Fig. 7 for pin numbers of the microphone socket.

Refer to Fig. 6 for the following explanation. When the reverse switch is thrown, a ground is placed through the switch to the junction of the new diode (D411) and R405. This ground is reflected through R405 and D409 to the base of Q403 causing it to conduct, tying processor lines R3 and K1 together. This is the signal to the processor to change to the offset frequency. At the same time, the ground from the microphone is blocked by D411 from getting to the transmitter board. Thus the radio remains in the receive mode, but on the transmit (offset) frequency.

Note that this is a receiver-reversing, not a transmitter-reversing switch; if the PTT switch is pressed while in the reverse mode, the transmitter will come up at whichever frequency is stored as the offset. Saying it another way, the transmit frequency is not affected by either position of this new switch. Also note that the reversing switch relies upon the stored offset to function; if the radio is in the simplex mode, throwing the reverse switch will do absolutely nothing.

Scan Hang Time and Scan Sample Mode

The idea of scan hang time—the pausing of the scan for a few seconds before continuing after a channel becomes clear—is certainly not new. But it is indeed a most welcomed asset; without it, any pause in the carrier on a scanned channel will result in the loss of that channel until the scan comes around again. While driving through a marginal area, every time the receiver squelches due to flutter or "picket-fencing," the scan will resume and the channel will be momentarily lost. The addition of a few seconds of hang time will correct this aggravating situation.

Another mode of scanning is the sample mode. In this mode, scanning proceeds normally until an active channel is found; however, instead of staying locked to that channel until it is cleared, the sample mode automatically forces a resume-scan trigger signal every few seconds. This allows a sampling of all active channels so that no one channel can lock out any other.

Under crowded band conditions this mode can become very confusing, but under the right conditions it can be very useful, giving a sort of priority channel function, ensuring that a certain channel will always be listened to at least once every few seconds. It seems that most hams have a favorite two or three repeaters they generally listen to, and if a "priority" repeater is programmed into every other memory location, then the listening duty cycle for that machine is very high and guaranteed by using the sample scan mode.

These last two additions are grouped together because the circuitry needed to implement them is centered around a single integrated circuit. Fig. 8 shows the circuitry involved with scanning. The important parts here are R406 and Q404. It is important to know that any time the SQ′ line (control-board point 75) is pulled low, Q404 will conduct and scanning will stop. To resume scanning, all that is necessary is that the SQ′ line be released to float high.

To begin a scan, something else happens, but once a scan is in progress, pulling line SQ′ low will stop the scan and letting it go high will immediately start the scan again. This will continue until the scan is permanently stopped by pressing one of the stop keys or by keying the PTT button.

Another important bit of information we need to know is what happens to the line SQ SIG (control-board PC edge-connector pin 14) when a channel becomes active and inactive. This signal comes from the receiver board squelch circuits and goes high (positive) when a channel becomes active. Typical values are 7.5 volts high, 0.1 volts low.

Referring to Fig. 8, we will first examine the unmodified circuit. In the V or vacant mode, the receiver scans until it finds a vacant channel. A vacant channel will pull the SQ SIG low; this will be inverted to a high by Q401 and back to a low by Q402. This low will exit the control board via point 73, pass through the scan switch to the SQ′ line, and stop the scan. In the B or busy mode, the receiver scans until it finds a busy channel. A busy channel will cause the SQ SIG line to go high. This is inverted to a low by Q401 and exits the board on point 74, passes through the scan switch to the SQ′ line, and stops the scan. In either of these modes, as soon as the channel activity changes (for example, from active to squelched), the SQ SIG line toggles and the scan immediately resumes. In the F or free-scan mode, the scan switch simply opens the SQ′ line and the receiver scans freely without ever stopping, regardless of channel activity.

It can now be seen that all that is needed to add some hang time to the B or busy mode is simply to add some delay to the SQ′ line after the channel has squelched. If we add this delay in the form of an OR gate to the existing circuit, then the scan will be stopped by an active channel and held by the tail-end delay. The sample mode is much the same except that we remove the SQ SIG squelch input to the OR gate so that the only thing that stops the scan is a timer pulse triggered by the channel activity; when the timer runs out, the scan resumes.

Fig. 9 shows the added parts and how they interface with the existing circuitry. The V or vacant mode works the same as it always has. In the B or busy mode, diodes D412 and D413 make up an OR gate feeding the SQ′ line through the scan switch. When a channel becomes busy, the SQ SIG line goes high and is inverted to a low by Q401. This low is fed through D412 to the SQ′ line stopping the scan. As long as the channel is active, the scan will be stopped.

Now look at IC403-A and B; these gates, together with C411 and R418, form a pulse generator. The output pulse is a low-going pulse of about 2.5 seconds duration and is triggered by a low-going pulse at IC403 pin 2. While the channel is active, the high on SQ SIG is double-inverted by Q401 and Q402 and blocked by diode D414. When the channel clears, a

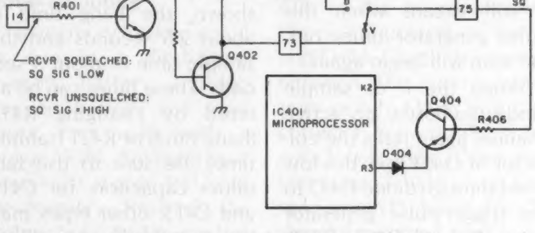

Fig. 8. Scan-control circuits before modification. Squelch activity enters board at pin 14 and arrives at scan-control switch Q404 either inverted or normal or not at all, depending upon the position of the scan switch. Scanning is stopped while Q404 is turned on; it resumes when turned off.

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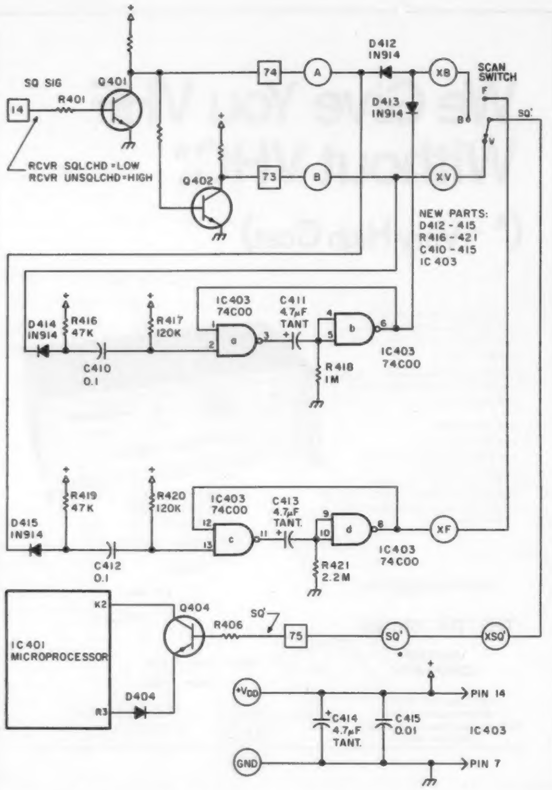
SQ SIG
14
R401
Q401
RCVR SQLCHD = LOW
RCVR UNSQLCHD = HIGH
Q402
74
A
73
B
D412
IN914
D413
IN914
XB
XV
SCAN SWITCH
F
B
V
SQ'
NEW PARTS:
D412 - 415
R416 - 421
C410 - 415
IC 403
D414
IN914
R416
47K
C410
0.1
R417
120K
IC403
74C00
C411
4.7μF
TANT
a
b
IC403
74C00
R418
1M
D415
IN914
R419
47K
C412
0.1
R420
120K
IC403
74C00
C413
4.7μF
TANT.
c
d
IC403
74C00
R421
2.2M
XF
IC401
MICROPROCESSOR
K2
R3
D404
Q404
R406
SQ'
75
SQ'
XSQ'
+VDD
GND
C414
4.7μF
TANT.
C415
0.01
PIN 14
PIN 7
IC403

Fig. 9. Scan-control circuits after modification. Numbers in squares refer to existing control-board pin or pad numbers. Numbers in circles refer to inputs and outputs on the new board. IC403A and B and IC403C and D are wired as monostable multivibrators triggered by D414 and D415, respectively. Squelch activity enters through pin 14, upper left. Scanning is stopped while Q404 is turned on; it resumes when turned off, lower left.

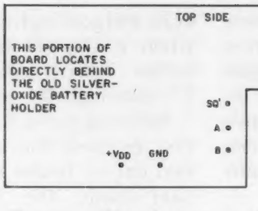
TOP SIDE
THIS PORTION OF BOARD LOCATES DIRECTLY BEHIND THE OLD SILVER-OXIDE BATTERY HOLDER
XF
X SQ'
XB
XV
SQ'
A
B
+VDD
GND

Fig. 10. Constructing the new scan-control circuits on a board this size and shape will allow them to fit neatly inside the control head between the control board and the potentiometer mounting board. The board is shown here as it would be viewed looking from the front of the Azden, down through the existing control board.

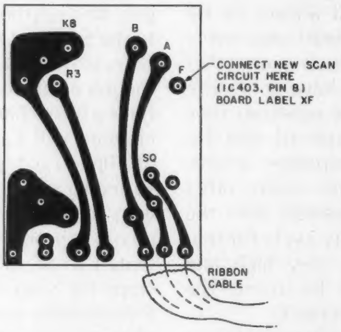
K8
B
A
R3
F
CONNECT NEW SCAN CIRCUIT HERE (IC403, PIN 8) BOARD LABEL XF
SQ
RIBBON CABLE

Fig. 11. Rear view of scan-mode switch showing point of connection from new scan circuit.

low is applied through D414 to the trigger-pulse generator made up of C410, R416, and R417. This trigger pulse is applied to pin 2 of the pulse generator, beginning a 2.5-second low pulse that keeps the scan stopped through D413. If the channel is still vacant when this pulse generator times out, the scan will begin again.

When the F or sample mode is chosen, an active channel again pulls the collector of Q401 low; this low is fed through diode D415 to the trigger-pulse generator composed of C412, R419, and R420. This triggers a 5-second low-going pulse which is fed through to the SQ' line and stops the scan. When this pulse times out, the scan begins again even though the channel is still busy. The reason for this is that the trigger-pulse generator, C412, has not reset and therefore cannot retrigger the holding pulse until the receiver restarts its scan.

With the parts values shown, the hang time is about 2.5 seconds and the sample time is about 5 seconds. These times can be altered by changing R418 (hang time) or R421 (sample time). Be sure to use tantalum capacitors for C411 and C413; other types may be too leaky to allow reliable operation. Do not substitute TTL NAND gates; the input impedance is substantially different and the timing will be completely wrong. Other CMOS NAND gates such as the CD4011 may be substituted, but be careful: The pinout will not necessarily be the same. The decoupling capacitors, C414 and C415, may not be necessary; they reflect my purist attitude in good circuit design.

The sample mode of scanning is implemented by using the old "free-scan" position of the scan switch. The output of the sample-mode pulse generator (IC403 pin 8) is fed to the unused switch terminal labeled F, as shown in Fig. 9.

Component layout is not particularly important for this circuit; the only real criterion is that the finished circuit fit within the confines of the control head. I used printed circuit techniques on an L-shaped board as shown in Fig. 10. This simple circuit can very easily be made by hand-painting the board using a small brush or resist pen. Vectorboard wiring is also a viable alternative. Even wire-wrap techniques could be used if the pins were limited to level-two height. After the circuit has been constructed, interconnect it to the control head as follows (see Fig. 10):

1) Connect a 3-inch twisted pair of wires to the new board at +Vdd and ground.

2) Connect a 3-inch twisted triplet of wires to the new board at SQ', A, and B.

3) Connect a 4-inch wire to the new board at XF.

4) Locate C403, a 470-μF electrolytic mounted on the foil side of the control board under the processor chip.

5) Solder leads +Vdd and ground across the leads of C403; observe polarity.

6) Locate the three-wire ribbon cable that comes from control-board points SQ', A, and B. Unsolder this cable from the control board and resolder it to the new board as follows: what was soldered to SQ', A, and B on the control board now connects to XSQ', XB, and XV on the new board, in that order.

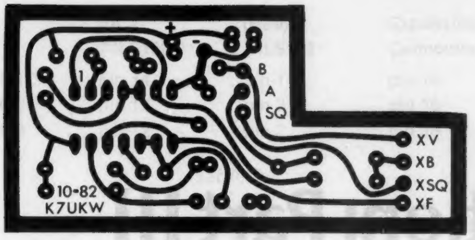

Fig. 12. PC board.

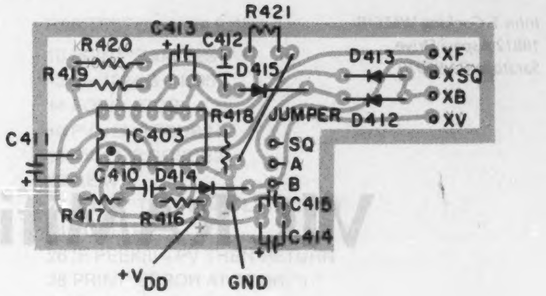

Fig. 13. Component layout.

7) Solder the triplet of wires to control board points SQ′, A, and B from the identically-designated points on the new board.

8) Solder the wire coming from point XF on the new board to the unused point F on the scan-mode switch's printed circuit board, as shown in Fig. 11.

After all connections have been made, wrap the board completely with electrical tape or heavy kraft paper to eliminate any possibility of short circuits. Now gently guide the board into the space between the existing control board and the potentiometer mounting board, keeping it well to the left side, directly underneath the old silver-oxide battery holder. Fold the connecting wires neatly into place beside and underneath the new board. The stiffness of the connecting wires and the ribbon cable serve to hold it in place adequately; no special mounting is really necessary.

Now solder the nicad battery in place as discussed previously, making sure that it is wrapped sufficiently so that it will not become pierced when crammed into the confines of the control head. The battery fits vertically in the space directly behind the scan-mode rotary switch. Remember, the external speaker jack was removed to make room for this.

Before sliding the battery in place, try to smooth up the rear solder connections on the PC board for the scan switch by snipping the sharp lug ends flush, using semi-flush-type diagonal cutters, a sharp knife, or similar tool.

Caution— be very careful not to drop clippings, filings, or bits of solder into the control head; hold the unit upside down when smoothing up these connections!

Now slide the battery into the space provided and reassemble the control head. The top plate with the bit of foam rubber on the inside mounts so that the foam is pressing on the old battery holder. A piece of electrical tape over the battery leads on the old holder will eliminate any possibility of a short to the cover.

Testing Your Work

Plug the control head and the main chassis back together and hook up power and an antenna. Turn on the main power switch and write several of your local repeaters into the memory. If you don't have that many repeaters, write in anything; right now we just want to make sure the memory backup is working. Now turn off the power and go have a cup of coffee.

After five or ten minutes, turn on the power again. Check the memory; all should be as it was before the power was killed. Now move the scan switch to the right-hand V position. Press the MSCAN button on the front panel. The receiver should stop at the first vacant channel encountered and stay there until the channel becomes active. Now advance the scan switch to the B position. If the receiver is not scanning, press the MSCAN button again. The receiver should stop on the first busy channel and stay there until it clears. It should then remain there an additional 2.5 seconds (approximately) before scanning resumes. Now switch the scan mode to F. This is the sample-scan position. The receiver should scan for a busy channel as before; however, after it lands on an active channel, it will stay there for only about 5 seconds and then resume scan automatically.

Now place an offset into the memory—either plus or minus will do. Watch the display and throw the reverse switch on the microphone. The display should change to the offset and the receiver will follow the display.

If a sensitive current meter is available, the standby current drain can be measured; it should be less than one microampere with the power switch off and the power cable connected to a source of 12 volts. Typically, it will read less than 0.1 microampere.

Troubleshooting

No memory backup could be due to a discharged memory battery; a fully-charged battery will read about four volts with a typical VOM. Anything over three volts should still hold the memory. Recheck the battery polarity; the control board has a plus and minus silkscreened near the old holder.

Too much standby current drain could be due to several problems. The only reliable way of finding out which is to trace the wiring step by step and isolate each possible load until the bad one is found. Begin by verifying that every circuit except the rf PA board is connected to the cold side of the power switch. Next, disconnect the power from the rf PA board (pull plug P301). The PA is located on the bottom side of the main chassis at the rear and is connected to the hot side of the power switch.

If the reverse switch doesn't work, check that it really is switching a ground all the way back to the control board; check that the polarity and location of D411 are correct.

A problem with the scanning modification must be either in the new board or in the connections to it (assuming the scanning worked properly prior to the modification). The pulse generators can be checked with a VOM by watching their outputs and pulling the trigger inputs low; with a grounded clip lead, touch the anode side of the trigger diodes. Check the polarity of D412 and D413. Check the wiring between the boards and scan switch. Make sure the correct F point on the scan switch was used (there are two points labeled F on the scan-switch PC board; Fig. 11 shows the correct one).

These modifications should give you even more enjoyment from an already superb piece of communications equipment. ■

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Saratoga CA 95070

VIC RAMification: Part III

Thank W6LOB for the memories.

In my previous article, "VIC RAMification: Part II," which appeared in the January, 1985, issue of *73 Magazine*, I mentioned an alternate procedure for VIC-20s using 2K-by-8 RAM chips. Later versions of the VIC-20 have a greatly reduced chip count. Where there had been eleven 2114 1K-by-4 RAM chips, there now are only three. Two of the remaining 2114s are used for the lowest 1K block of RAM (including page zero) and the third is for color memory. The eight missing 2114s have been replaced by two 2K-by-8 chips. I used HM6116s in this second procedure. I believe that TMM2016s will do as well.

I would also like to apologize for an error I committed in the first article. Wherever I made reference to pins 4, 5, and 6 of the 74LS133, it should have been to pins 5, 6, and 7. This error occurs in Table 1, twice in step 5, and once in step 7 of the procedure section.

The theory of operation remains the same as specified in the earlier article. The list of materials and tools is changed only by the substitution of two HM6116-4s for the 2114s. The 6116s can also be obtained from JDR Microdevices, 1224 S. Bascom Avenue, San Jose CA 95128, for $4.75 each. The major change is to the procedure section. The newer VIC-20 has a much different parts layout and a much narrower board. Despite this, its basic functions remain unchanged.

Procedure

1) Open up the VIC. There are three Phillips screws under the front edge of the VIC. Remove these and gently lift the front. The case is hinged at the back. Unplug the keyboard cable and the power-indicator lamp cord.

2) Locate the 6116s. (See the previous article if your VIC uses 2114s.) The 6116s are directly in front of the 6522s and are designated U15 and U14. They are 24-pin chips, and regardless of the number on the top of them, they are equivalent to HM6116s. You may ignore the three 2114s which are directly to the right of the 6116s.

3) Locate the chip-select gate, the 74LS138, which is second from the left in the row of chips directly below the expansion connector. Its designation is UC4. It is used as an address decoder providing chip-select signals (low) for each 1024-byte piece in the first 8192-byte block, which we could call BLK0. We are interested in the select lines for RAM1, RAM2, and RAM3. These signals travel to the expansion connector and also to the data-bus control chip, the 74LS133, designated as UD9.

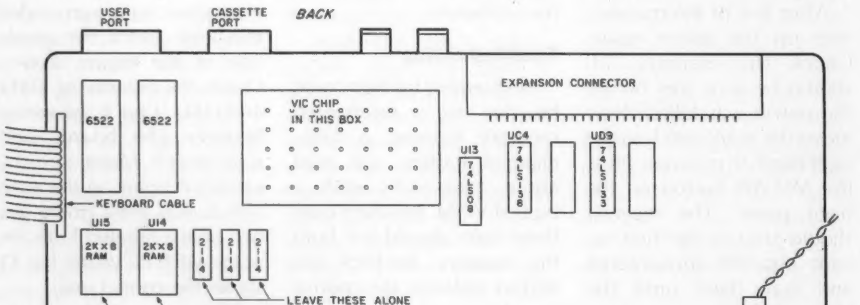

Fig. 1. Inside the VIC-20. Piggyback your new memory only where shown.

4) Locate data-bus controller UD9. This chip is located fourth from the left in the row below the expansion connector. Table 1 shows the connections of the chip-select signals. It would be wise to verify the specifications presented here with a VOM.

5) Cut traces. This step is taken to stop the VIC from shutting off the data-bus transceiver when RAM1, RAM2, or RAM3 are accessed. To cut the traces you must first remove the VIC board from the case bottom. It is attached to a metal carrier by three small machine screws and by solder tabs. Remove the metal carrier from the case bottom, and then remove the carrier from the VIC board by heating the solder tabs and prying them up.

Remove the three small machine screws, and the board is free. The traces to cut are at pins 2, 3, and 11 at UD9, at pins 12, 13, and 14 of UC4, and at pins 14, 15, and 16 at the expansion connector. Also cut the traces between pin 1 and pin 2 and between pin 2 and pin 7 of U13 (74LS08).

Use the X-acto® knife for this task. *Here are two warnings!* First: When you turned the board over, the relative position of the pins changed. What was once on the left is now on the right. Be extra careful that you are cutting the correct traces. Second: Make two cuts very close together and pry out the tiny chunk of copper, and don't let it get under any of the chips. Wet the end of

	(UC4) 74LS138	(UD9) 74LS133	Expansion Connector
RAM1	pin 14	pin 11	pin 14
RAM2	pin 13	pin 3	pin 15
RAM3	pin 12	pin 2	pin 16

Table 1.

RAMTEST program listing

```
10 PRINT"RAM TEST"
12 A = 1024:B = 4095
14 FORI = ATOB
16 PV = 85:GOSUB24
18 PV = 170:GOSUB24
20 NEXT
22 PRINT"TEST COMPLETE":END
24 POKEI,PV
26 IF PEEK(I) = PV THEN RETURN
28 PRINT"ERROR AT ADDR.";I
30 PRINT"DATA IS";PEEK(I)
32 PRINT"SHOULD BE";PV
34 RETURN
```

SCRMOV program listing

```
10 POKE 36869,144
12 POKE 648,4
14 FOR J = 217 TO 228:POKE J,132:NEXT
16 FOR J = 229 TO 250:POKE J,133:NEXT
18 POKE43,0:POKE44,6:POKE1535,0
20 CLR:NEW
```

Alternate load address procedure (direct mode):

```
POKE43,1:POKE44,16:POKE4096,0:CLR
```

Program listings.

your little finger and remove the scrap from the board.

Now, using a short piece of stripped wire-wrap wire, connect 74LS133 pins 2, 3, and 11 to 74LS133 pin 16. This will ensure that these three inputs will stay high, being tied to plus five volts. Connect pin 12 of UC4 (74LS138) to pin 1 of U13 (74LS08). Connect pin 13 of UC4 (74LS138) to pin 1 of U13 (74LS08). Verify these new connections (and disconnections) with the VOM.

6) Install 6116s. This step takes the most time. We are going to piggyback two new 6116 RAM chips on top of the on-board 2K-by-8 RAM chips. Make sure that all the pins on the new 6116s are parallel. Test-fit them on the on-board RAMs. The new chips should fit snugly without forcing.

Locate the chip select (pin 18) and the output enable (pin 20) on each of the new 6116s and bend them outward until they are ninety degrees to the other pins. Put each chip into the third-hand vise and lightly tin the inside of each of the pins. Place the two new 6116s piggyback on the on-board RAM chips.

Leave some breathing room between the on-board chip and its piggyback partner. Be sure you have oriented the new chips correctly. Pin 1 on these chips generally is indicated by a notch on one end. Pin 1 should be at the upper left-hand corner.

Tack-solder each chip to pins 1, 13, 12, and 24. These are the pins on each of the corners. After each chip has been tacked on, briefly touch each pin's junction with the soldering iron for all the rest of the pins. Check continuity of pin 1 of the new chip to pin 1 of an on-board chip without a piggyback partner. Do this for each pin with the exception of pins 18 and 20.

Note any pins showing an open circuit. Use the tip of the X-acto knife to gently push and hold the pin while applying the soldering iron. Retest the continuity with your VOM.

7) Prepare the chip-select lines which will connect each 6116 to the chip-select outputs. Connect pins 18 and 20 of one 6116 to pin 14 of UC4. These connections are made on the top of the board.

Connect pins 18 and 20 of the other 6116 to pin 3 of U13 (74LS08). Pin 14 of UD4 is the RAM1 select signal. We are using only half of the 6116 connected to RAM1. RAM2 and RAM3 are ORed by the 74LS08 to develop the chip select for the other 6116.

How can an AND gate perform an OR logic function? There is a theorem which states: A positive-logic AND is a negative-logic OR. Pin 3 will be high when RAM2 and RAM3 are high; that is, neither is active. Pin 3 will be low, selecting the 6116, if either RAM2 or RAM3 is low.

Check the continuity of these connections with the VOM. Now make a *non-continuity* check to ensure that the RAM1, RAM2, and RAM3 select lines are NOT connected to pins 11, 3, and 2, respectively, of the 74LS133.

8) This completes the hardware modifications. Before you put your VIC-20 back together and plug it in, here are some items you chould check very carefully.

- First, are there any loose chunks of solder or bare wire lying around on the board?
- Second, are there any solder bridges between pins on the piggybacked RAM chips?

The third point may sound silly. It isn't. In the modification described in my previous article, I installed one of my 2114s backward. I found out during testing.

- Be sure your 6116s are all pointing north, as it were.

After your work passes this visual inspection, reinstall the board in the case bottom.

9) Button up the VIC. Screw the board to the shield carrier and bend the tabs over. After testing is complete, resolder the tabs to the board. Attach the carrier shield with the circuit board to the case bottom. Do not get the screws for mounting the board mixed up with those for fastening the case bottom to the case top (keyboard).

Hinge in the case top; connect the keyboard plug on the left and the power-on light plug on the right. For initial testing, you may want to leave the case top free or even off to the side a little. For final assembly, fasten the case top to the bottom with the three long screws.

Testing

Please refer to my January, 1985, article in *73* for the sections on testing and moving the screen. Basically, when you power up your VIC-20 after this modification, you should receive the message "6655 BYTES FREE." I had neglected to cut the trace connecting pin 14 of UC4 to pin 11 of UD9; thereby depriving myself of 1024 bytes of added memory. A couple of swipes with the trusty X-acto and all was well. ■

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A. Finkel, N. Harris, P. Higginbottom, and M. Tomczyk, ***VIC-20 Programmer's Reference Guide***, Commodore Business Machines, Inc., and Howard W. Sams & Co., Inc., 1982.

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John T. Cocking, "VIC RAMification: Part II," 73, January, 1985, pp.22-24.

Yesterday's Circuits Today

Remember tubes? W6HDM does. He's resurrected a half dozen of his favorite circuits and updated them with semiconductors.

Irving M. Gottlieb W6HDM
931 Olive Street
Menlo Park CA 94025

Various circuits and techniques have had their day in the sun, only to be relegated into near oblivion by advancing technology, changing economic priorities, or by being somewhat less than practical; this has been true especially during times when the supporting technology was not that great. In electronics, as in other endeavors, the quest for better performance, higher efficiency, and reduced cost has evoked interesting schemes for squeezing more blood from the turnip. (Indeed, some innovators must have originally had perpetual-motion precepts on the mind.) It should, in any event, prove rewarding to review a few of these ideas and implementations. It is just possible that with modern devices and components, new life may be infused into an obsolete technique. Also, as is often the case, one thing leads to another and new concepts evolve from previous methods of problem solving.

The Reflex Receiver

A noteworthy example of yesteryear's pursuit of something for nothing was the reflex radio receiver. In its original and most prevalent form, a tuned rf receiver was so configured that an rf amplifier stage—usually the first—also served as the first audio-frequency stage. At first thought, such a concoction appears totally asinine. Common sense tells us that such a set would necessarily be plagued with all kinds of feedback problems and instabilities. Actually, how-

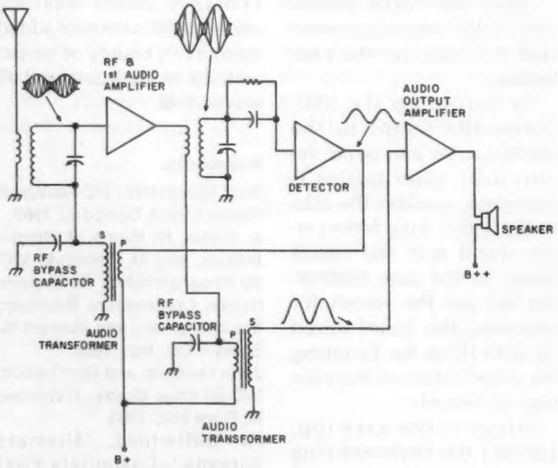
RF & 1st AUDIO AMPLIFIER
AUDIO OUTPUT AMPLIFIER
DETECTOR
SPEAKER
B++
S
P
RF BYPASS CAPACITOR
RF BYPASS CAPACITOR
AUDIO TRANSFORMER
AUDIO TRANSFORMER
B+

Fig. 1. Basic functional diagram of the reflex receiver. Although the stages were originally configured around tubes, it should be feasible to use solid-state devices such as transistors, FETs, or ICs.

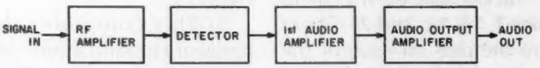
SIGNAL IN
RF AMPLIFIER
DETECTOR
1st AUDIO AMPLIFIER
AUDIO OUTPUT AMPLIFIER
AUDIO OUT

Fig. 2. Block diagram of equivalent receiver to the setup shown in Fig. 1. This is a conventional (unreflexed) system utilizing four amplifying devices instead of the three which sufficed for the reflex receiver. More complex reflexing arrangements can be used to eliminate additional stages.

ever, reflex radios were "hot" performers and there was generally nothing to distinguish their performance from more conventional circuits except that a three-tube reflex set would, indeed, exhibit four-tube capability. Even those reflex circuits which also included regeneration operated quite stably. Let us see why, our first intuitions notwithstanding, reflexing proved a feasible technique.

The schematic of a reflex set is shown in Fig. 1 and the block diagram of the equivalent receiver is shown in Fig. 2. It is easy enough to see that the rf stage also performs as an audio driver stage, but a little explaining is in order to illuminate how this is possible.

In order for an amplifier, be it tube, transistor, or IC, to process two different frequency bands without interaction between them, two requirements must be met. First, amplification must be *linear* so that no "mixing" or heterodyning occurs. This is readily complied with by ascertaining that the amplifier always operates in its class-A mode. Second, the frequency bands should be sufficiently different so that the outputs of the reflexed amplifier can be channelized easily to where they are supposed to go, and so that it is easy to get rid of frequencies that try to go into wrong places. This is accomplished easily in broadcast-band reflex radios because of the great difference between broadcast carrier frequencies and audio frequencies. Resonant tank circuits eliminate audio frequencies, and simple bypassing to ground eliminates straying radio frequencies.

The Regenerative Modulator

The regenerative modulator is a novel and unique circuit. Its mystique is enhanced by its very name—it is not a modulator with positive feedback unless you are prepared to stretch words a bit. A better name would be stimulated oscillator, or subharmonic generator, for that is what actually takes place: An input signal provokes an output at an integral submultiple of the input frequency. Granted, this is commonly accomplished with cascaded flip-flops. For example, a digital watch contains such a frequency divider for reducing the nominally-32-kHz crystal-oscillator frequency to one Hertz. And, of course, similar digital-divider systems are used in frequency counters, phase-locked loops, digital multimeters, and elsewhere.

The regenerative modulator is different in an interesting way. It is an "analog" circuit that operates from and produces a sine wave! It is capable of preserving either FM, SSB, or AM modulation. Regenerative modulators probably originated in the carrier-telephone industry, and it appears that the circuit was used more in England than in this country. At one time, hams used it and similar circuits to get crystal control on 160 meters (when only 80-meter crystals were available).

The basic principle of the regenerative modulator can be understood by referring to the block diagram in Fig. 3. It takes a little brain work to see what actually goes on. Once the theory of operation is mentally digested, you are certainly going to be heard exclaiming, "Now why didn't I dream that up?"

The circuit depends for its behavior on two nonlinear amplifiers and two bandpass filters. The first nonlinear amplifier is very similar to a mixer stage in a superhet: It samples two input frequencies and delivers a difference frequency. This difference frequency happens to be the *output frequency* of the circuit and is supported by the first bandpass filter or tank circuit.

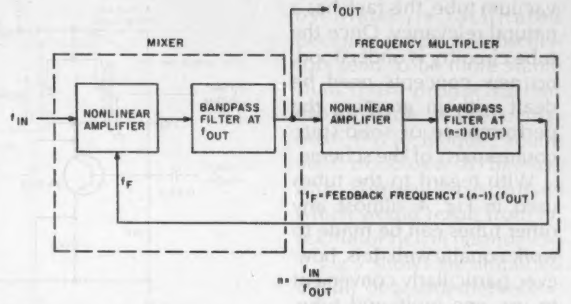

Fig. 3. Block diagram of the regenerative modulator. The amplifiers can be either tube or solid-state devices. The bandpass filters can be simple parallel-resonant circuits. The basic function of this arrangement is that of a frequency divider. Unless the proper frequency is applied to the input (f_{IN}), there is no output.

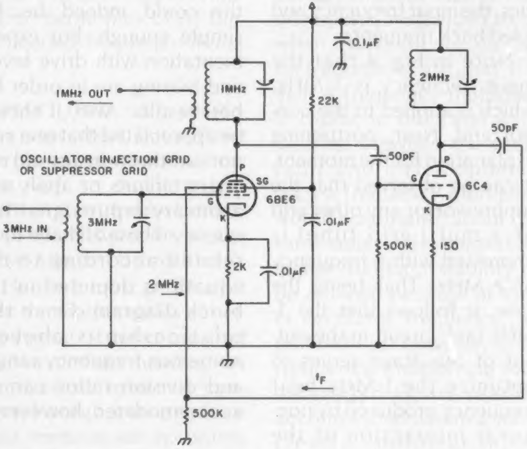

Fig. 4. An experimental tube version of a regenerative modulator. Strong drive is needed so that the tubes are operated in their nonlinear regions. The first tube can be any of a variety of multi-grid tubes such as converters, pentodes, etc.

The second nonlinear amplifier is very similar to the frequency multipliers commonly used in transmitters, although it usually is biased close to class-B rather than class-C operation. The harmonic output of this stage is supported by the bandpass filter or resonant tank in its output circuit. Finally, this harmonic frequency is *fed back* to the mixer stage. In order to visualize what happens, it should first be driven home that absolutely nothing transpires without input signal f_{IN}. Thus, despite the feedback loop and the apparent opportunity for interaction between the stages, the circuit remains inoperative with no input signal. Feedback notwithstanding, the tuned circuits are not appropriate for self-oscillation. Now, let's see what takes place when an input signal of the right frequency is applied to the regenerative modulator.

It is probably easiest to follow the operating sequence by referring to an actual circuit rather than to a block diagram. For this purpose, consider the tube version shown in Fig. 4. Inasmuch as original applications of regenerative modulators were implemented during the heyday of the vacuum tube, this tack has a natural relevancy. Once the tube circuitry is understood, no new concepts need be dealt with in grasping the performance of solid-state counterparts of the scheme.

With regard to the tubes used in Fig. 4, almost any other tubes can be made to work equally well. It is, however, particularly convenient to use one multi-grid tube, such as a converter or a pentode with external connection to the suppressor grid. The reason for this is that the first tube is required to output a difference frequency resulting from inputs impressed with *two* frequencies, the input frequency and a fed-back frequency.

Note in Fig. 4 that the input frequency is 3 MHz, which is applied to the control grid. Next, postponing explanation for the moment, it can be observed that the suppressor (or any other grid of a multi-grid tube) is impressed with a frequency of 2 MHz. That being the case, it follows that the 1-MHz tank circuit in the output of this stage serves to optimize the 1-MHz beat frequency produced by nonlinear interaction of the input frequencies within the tube. This, of course, is similar to the operation of mixers in superheterodyne receivers. In this particular application, however, we naturally ask what keeps the process going—in other words, why should the 2-MHz input obligingly appear?

The neat little trick that is used utilizes the second tube as a frequency multiplier. It is driven by the 1-MHz frequency we already *assumed* was generated by the first tube. The resonant tank in the output circuit of the frequency-multiplier tube supports the required 2-MHz feedback frequency.

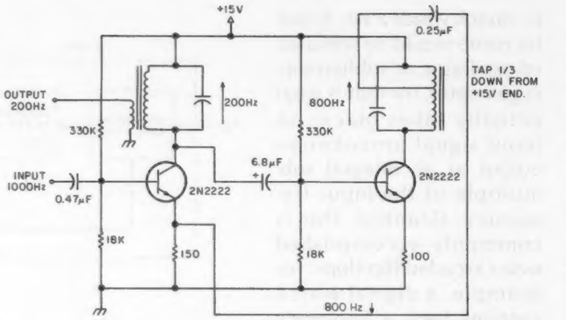

Fig. 5. An experimental transistor version of a regenerative modulator. Although this example circuit operates at low audio frequencies, the basic idea is applicable to radio frequencies as well.

But that is where we came in! Admittedly, a little trickery was indulged in this explanation because it was assumed that the circuit was *already* performing and then we proceeded to show *why* this could, indeed, be. It's simple enough, but experimentation with drive levels and biasing are in order for best results. Also, it should be appreciated that one cannot just throw in any old resonant circuits or apply any arbitrary input-signal frequency. These all have to be related according to the equations depicted in the block diagram. Once this relationship is obeyed, numerous frequency ranges and division ratios can be accommodated, however.

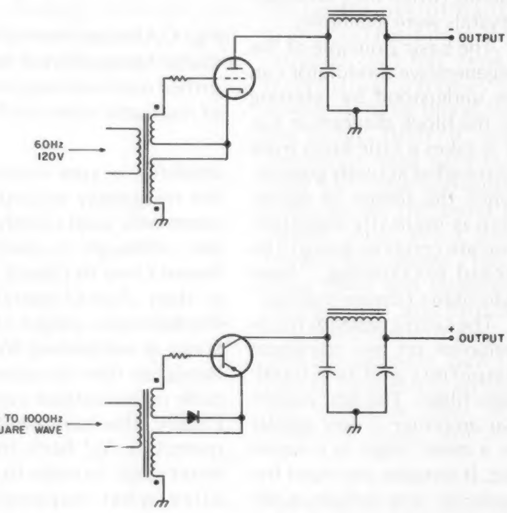

Fig. 6. Tube and transistor versions of the synchronous rectifier: Tube circuit (top) did not provide any noteworthy performance features; transistor version is capable of high-efficiency rectification for high currents and low voltages because internal voltage drop can be much less than for ordinary rectifier diodes.

The transistor version is shown in Fig. 5. In this instance, the regenerative modulator operates at audio frequencies. Essentially the same principles prevail as with the tube circuit.

The Synchronous Rectifier

Although the notion of synchronous rectification is as old as the hills, don't be too surprised to find its implementation in some of the most sophisticated modern power supplies. Its basic concept is simple enough—by applying the appropriate signal to the control element of an amplifying device such as a tube or transistor, you can make it conduct for the better part of just one polarity of an applied ac wave. In other words, you have accomplished rectification. It so happens that the enabling signal must be applied to the control element in *synchronism* with the wave you wish to rectify; therefrom stems the term "synchronous rectifier." The question before the house is *why* do it this way when we have no end of specialized diodes specifically designed for use as rectifiers?

The quick answer is that the synchronous rectifier is capable of developing appreciably less forward voltage drop than conventional silicon diodes when they were the last word in rectification efficiency. But the bottom line is that the synchronous rectifier can, in some cases, compete favorably with the modern Schottky diode in the matter of forward voltage drop. And, at least for low-frequency work, the synchronous rectifier tends to be more economical to use in production equipment.

In order to grasp the significance of the "resurrected" synchronous rectifier, it should be understood that, with bipolar transistors, its application is limited to low-voltage (say five volts), high-current power supplies. And it is frequency-limited to something in the mid-audio range, at best. No pretense is made that is usable for 20-kHz square waves. But for 60 Hz, its rectifying efficiency can be superb. It is feasible to rectify 25 or 50 Amperes and incur a forward voltage drop on the order of ¼ volt, or less.

Before we go any further, it must be explained that the synchronous rectifying element we have been talking about is none other than the germanium power transistor. If you thought this device was extinct, think again—there remain several semiconductor manufacturers that still make germanium power transistors. And the *synchronous rectifier* is one of the applications they are pushing. This all comes about because $V_{CE\ (sat)}$ for these devices is only about 0.2 volts. Note that this is much less than the 0.65 volts or so for the silicon rectifying diode. For high currents, it is also less than the voltage drop produced by germanium rectifying diodes. If you are rectifying five volts at several tens of Amperes, a few tenths of a volt can be very significant in terms of dissipation and efficiency.

The synchronous rectifier has had its ups and downs. In its tube version, it never really had much to offer—there was no particular advantage in most cases in using it in lieu of conventional rectifier circuits. And in solid-state practice there have been myriads of dedicated junction rectifier diodes available for service in simple rectifier circuits. Nonetheless, we find that power-supply engineers have found a new virtue in this old technique.

Roughly analogous tube and transistor versions of half-wave synchronous rectifiers are shown in Fig. 6. The tube version is duck soup to implement because nothing bad happens when the plate polarity reverses. In the transistor version, precautions have to be taken to prevent reverse load current from finding a conductive path back to the emitter. Otherwise, the fact that the output polarities of the rectified current are different in the two circuits is not significant—it comes about because the tube is an NPN device and the power transistor shown is PNP.

Semiconductor firms are now developing special power-MOSFET devices for synchronous-rectifier service at higher voltages and higher frequencies.

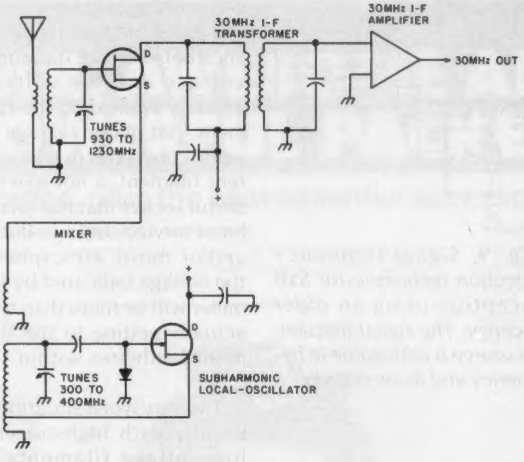

Fig. 7. Simplified circuit of the "business end" of a superhet, with subharmonic oscillator. Contrary to common assumption, the oscillator does not provide harmonics of its fundamental frequency. Rather, the needed frequency multiplication takes place in the mixer.

The Subharmonic Local Oscillator

An interesting circuit technique that has been in and out of fashion over the years is the submultiple or subharmonic local oscillator in a superheterodyne receiver. Basically, the scheme consists of using an oscillator with some fraction of the needed frequency in order to convert the incoming signal to the proper i-f band. This being the case, it often has been erroneously supposed that this is feasible by virtue of the harmonics generated by the oscillator. To see that this is not the *modus operandi*, one must appreciate the reason such an arrangement is used in the first place.

In UHF and microwave applications, it is not always easy to obtain the desired frequency stability from the local oscillator. If, however, the oscillator could operate at one-half or, say, one-third of the needed frequency, the stability problem tends to be greatly alleviated. However, it is also true that really stable oscillators produce nearly pure waveforms, i.e., sine waves without much harmonic energy. So for this reason the commonly assumed "harmonic output" from such oscillators is incorrect. But without harmonic generation, how can such an oscillator perform its intended frequency-translation function in the mixer stage of the receiver?

Here we must delve a bit into the mathematics of heterodyning. It turns out that with a certain proviso, an appropriate mixer or converter stage can produce beat frequencies according to the relationship: $f = w \pm nq$, where w is the incoming signal frequency (from the antenna), q is the local-oscillator frequency, and n is any whole number. This being the case it is a straightforward matter for selecting the desired i-f via resonance in the i-f transformer windings.

The proviso for this scheme to work is that the mixer or converter must have a transfer characteristic described by an exponent greater than 2. When this stipulation is met, that is, when the mixer is sufficiently nonlinear, the needed harmonics are generated *in the mixer*. Accordingly, a harmonic-rich oscillator is *not* needed.

The overall result is similar to what one might obtain from an oscillator with harmonics, but the design of the oscillator is facilitated because pure-wave oscillators tend to be more stable than those producing harmonic-rich waveforms. (Also, this technique circumvents troubles with "birdies" and spurious responses which would result from an oscillator rich in harmonics.)

Fig. 7 shows the simplified circuit of a superhet-receiver front end in which the local oscillator covers a frequency range which is only one-third as high as would be needed in the "conventional" approach. Despite the fact that the oscillator frequency is this low, the same range of signal frequencies is responded to as when conventional oscillator frequencies are used. It is as if a frequency multiplier (a tripler, in this case) were inserted between the oscillator and mixer. Indeed, such a frequency multiplier would accomplish about the same objective—permitting higher oscillator stability to be attained because of lower oscillator frequency. As pointed out, however, both frequency multiplying and heterodyning are readily accomplished within a sufficiently nonlinear mixer stage.

The FET mixer of Fig. 7 is only marginally nonlinear enough for the purpose and does not produce high conversion gain. A bipolar transistor would be better in this respect, but the FET circuit tends to be superior in signal-to-noise ratio. In either case, oscillator drive is critical for optimum performance because the requirements for harmonic generation and heterodyning are not quite the same. Although this circuit fell out of favor with the advent of high-frequency transistors, there has been renewed interest as experimentation is carried out for satellite communications equipment. Additionally, the technique is not uncommon in millimeter radar and communications technology.

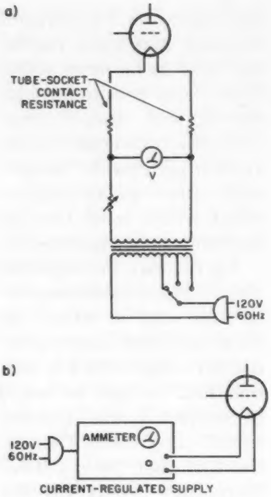

Fig. 8. Traditional and proposed methods of lighting up your transmitting-tube filaments: (a) the "good old way" and manually-adjusted voltage across tube socket may not have been so good after all; (b) proposed technique.

Transmitter-Tube Filaments and a Better Way to Fly

For many years the ham has been admonished by tube makers to maintain the filament *voltage* of his transmitting tubes within a prescribed range. For optimum performance and life span, this range is often cited as plus or minus five percent. This hasn't always been readily feasible for a number of reasons. The variations due to swings in the utility voltage and those accompanying key-up and key-down operation can easily fall outside of this narrow tolerance. And it goes without saying that the accuracy and readability of analog voltmeters have often contributed to an illusion of adherence to specified operation. There are also a couple of other matters pertaining to constant-voltage operation of tube filaments that, in this author's opinion, have not been accorded deserving discussion in the past.

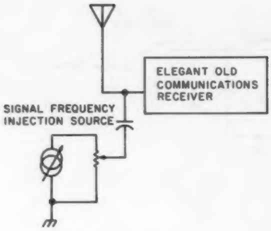
ELEGANT OLD COMMUNICATIONS RECEIVER
SIGNAL FREQUENCY INJECTION SOURCE

Fig. 9. Signal-frequency injection technique for SSB reception using an older receiver. The signal-frequency source is adjustable in frequency and in amplitude.

First, the technique of measuring filament voltage by connecting the voltmeter across the tube-socket terminals can be responsible for errors of several percent even if one uses a modern high-precision digital meter. This pitfall stems from the contact resistance between the socket and the tube pins. Under best conditions (a low-current filament, a new high-quality socket, and a clean, dry atmosphere) there will be a negligible difference between the measured voltage and the voltage actually applied to the filament. But under average to worst conditions (a high-current filament, a not-so-wonderful socket that has seen a bit of service, and a polluted and/or moist atmosphere) the voltage indicated by the meter will be more than that actually getting to the filament leadwires within the tube.

The very worst situation is usually with high-current, low-voltage filaments in high-power tubes, for then the voltage drop due to contact resistance tends to be an appreciable percentage of the intended or specified voltage. Contact resistance unfortunately varies with spot temperature, contact pressure, and with surface conditions of the contacting metals. Corrosion may or may not be obvious.

The second matter has to do with the *basic notion* of maintaining a near-constant filament voltage. In perusing older literature on tube operation, I found that it appears that the true objective is to maintain a prescribed near-constant *current* through the filament. After all, thermionic emission is dependent upon filament temperature, which is more directly a function of current than of voltage. This may seem like splitting hairs, but it will be shown that better operating conditions and, very possibly, better tube life can accrue from this nontraditional approach. Indeed, one of the rewarding things about reviewing older circuit techniques is the realization that they can be either resurrected or improved using modern technology and practices.

If you are willing to buy the current-dependent concept of filament operation, the next step should almost suggest itself—the use of a current-regulated dc supply. One answer to why such a technique did not gain footing with yesteryear's hams is that a high-current regulated-power supply suitable for powering tube filaments was not an easy thing to build in pre-solid-state days. Its initial cost as well as its bulk and low efficiency would certainly have proved discouraging. Today, it is a trivial matter to construct inexpensive and compact regulated supplies. One also has the choice of using the series-pass "linear" approach, or for greater efficiency, the switching technique. Moreover, it is just as easy to make a constant-current supply as it is to make the more conventional constant-voltage supply.

One reason for going to constant-current operation has already been cited—the basic dependency of electron emission on heat-producing current. Another reason is the beautiful situation whereby the filament is caused to operate at the same temperature *despite* variations in the socket-contact resistance. That is the nice thing about a current-regulated supply—even though the overall load resistance may vary, load current remains constant! Although a voltage-regulated supply would gain us freedom from the effects of ac line voltage variation, tube-socket resistance variations would still affect the *true* filament voltage and its resulting current!

Summarizing our revamp of the traditional method of

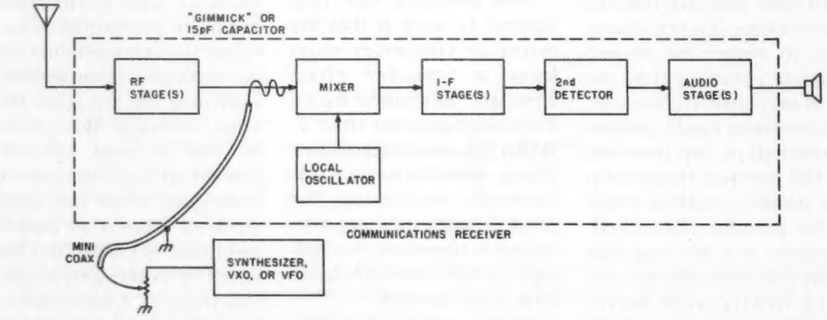

Fig. 10. A somewhat better arrangement for receiving SSB signals with an older set. In this setup, the signal-frequency injection takes place following one or more rf stages. Also, the use of a synthesizer is suggested.

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powering transmitting-tube filaments, we have agreed (hopefully) to automatically regulate filament *current* and, although it has not been explicitly mentioned, we have agreed to the use of dc. Thus, a dc-current-regulated supply will be adjusted to provide a prescribed filament current and we will let filament voltage ("true" or otherwise) swing around to its heart's content. Fig. 8 compares the traditional and the proposed methods. In Fig. 8(b), tube-socket contact resistance is not shown because it is no longer a factor affecting thermionic emission.

A natural question with regard to this proposed practice is what do the tube manufacturers think about it? Not only have I been unable to extract strong opinions from them, but there has been little consistency in the meager information that has been forthcoming. For one thing, their feet are in concrete: You adjust for a voltage reading with a rheostat or autotransformer—that's simply the way it has always been done! I can't help wondering if it is subliminally suspected that the constant-current technique might lead to more widely-spaced tube replacements because of greater longevity! (Constant-current operation would do away with high-inrush current to cold filaments—a life-span-reducing phenomenon.)

Signal-Frequency Injection for SSB—An Update

An interesting circuitry technique stems from the 50s and 60s, when single-sideband communication was gaining a foothold in the ham bands. It was found that otherwise-superb receivers either could not respond to SSB signals or were very unstable when the i-f beat-frequency oscillator was used to demodulate that mode. Many hams found that a practical solution to this dilemma was signal-frequency injection. This technique simply made use of a stable oscillator to inject the missing carrier at the receiver's input along with the SSB signal itself. The scheme, in its simplest form, is depicted in Fig. 9.

An example of signal-frequency injection for the reception of SSB signals is a Hallicrafters model SX-25 receiver used in conjunction with a BC-221 signal generator, resulting in very satisfactory reception of 80-meter SSB stations. Initial tuning was done with the receiver. This served to locate the station; then the BC-221 signal generator was tuned to the missing carrier of the station, this being manifest by demodulation of the previously garbled audio which now became intelligible.

The significant aspect of this technique was that the SSB station remained intelligible for long periods of time—there was little tendency for it to slide into Donald Duck lingo. What this says, of course, is that the frequency stability of the BC-221 signal generator was exceedingly good—much better than the i-f bfo in the receiver. Interestingly, the BC-221 oscillator is self-excited. Think, then, how much better stability might be derived from a crystal oscillator.

We are rapidly homing in on an interesting design technique, resurrecting the use of signal-frequency injection. You can bet your boots that hams of that period also made use of the vxo for injecting the missing carrier of SSB signals. Of course, one of the shortcomings of the vxo is its inability to provide wide frequency coverage. This can be remedied via the use of multiple crystals and this, indeed, was also resorted to.

It so happens that many hams still have elegant old communications receivers that are capable of good SSB performance with signal-frequency injection. But today's ham has a new circuitry technique in his technical arsenal—the *frequency synthesizer*. I have not seen evidence of the use of the frequency synthesizer for such a purpose and would like to suggest it. It would appear that a very effective overall receiving system for SSB could now be implemented by the association of a frequency synthesizer with an older communications receiver. This would be yet another example where a nearly-forgotten circuit application could be profitably revived in today's ham shack.

The scheme depicted in Fig. 10 makes use of the suggested synthesizer and also incorporates a more desirable method of signal injection. Advantage is taken of the fact that many older communications receivers have one or more tuned rf stages ahead of the mixer or converter. By injecting the signal frequency at a point following one of these rf stages, radiation of interference is reduced to a negligible level. Note that the surgery required for the set remains minimal.

Of course, other refinements will suggest themselves such as optimization of time constants in the avc system and possibly the substitutions of a product detector for the one that sufficed for AM listening. But the bottom line of this discussion involves the suggested synthesizer, which either was not around or didn't fit ham budgets when signal injections were first experimented with. Although older receivers are often "boat anchors" with regard to size and weight, some are truly classic when one considers their performance. It would be a shame to relegate such a set to the scrap heap if a simple stratagem can be employed to remedy a shortcoming or two.■

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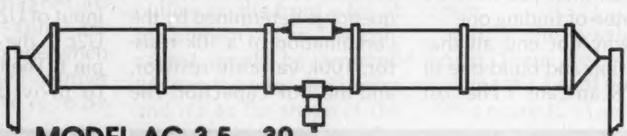

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If you are the owner of a KDK 2016A, you know how frustrating it is to find those repeaters when you are on a trip. The *Repeater Directory* is of little help because I have found that a good number of the listed repeaters are no longer on the air. It takes a good amount of dexterity to manually switch through three thousand positions to find a repeater that is on the air—and even then you have no guarantee of finding one.

So why not end all that frustration and build one of these "Scan Cans"? The cost is low—less than ten dollars if you have a well-stocked junk box. The unique modular design lends itself to future expansion with other types of function modules. The circuit is simple and straightforward for ease of construction and troubleshooting.

Theory of Operation

See the schematic in Fig. 1. The clock circuit, U1, is an astable oscillator. Its frequency is determined by the combination of a 10k resistor, 100k variable resistor, and the 1-uF capacitor. The 100k variable resistor adjusts the frequency rate of the clock and the speed at which the Scan Can scans.

It is necessary to explain the terminology used for 8 volts and ground. A high (H) is +8 volts and a low (L) is ground.

The function of U2a pin 1 and U3c is to control the scan function. When U2a is high, the clock pulses on pin 2 are passed through to the input of U2c and inverted by U2c to the clock input of U4 pin 1. The function of U2c is to provide a two-phase clock for future development. When S1 is in position 1, the 100k resistor pulls U2a pin 1 to H and allows the unit to scan. When S1 is in position 3, at L, scanning stops.

In the same manner, the combination of U3c, U7b, and Q1 control the Receive Hold function of the Scan Can. Q1 serves as a buffer switch and interfaces with the receive LED of the KDK. A 2-volt potential on the base of Q1 forces the collector to go low. When U7b pins 5 and 6 are L, then pin 4 of U7b goes H. When U3b pin

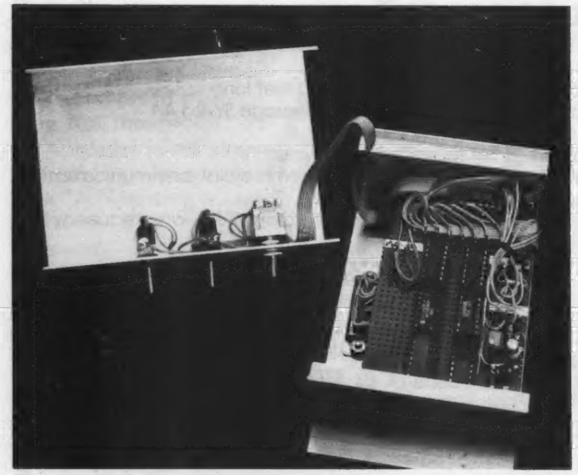

Photo A. The Scan Can showing the board layout.

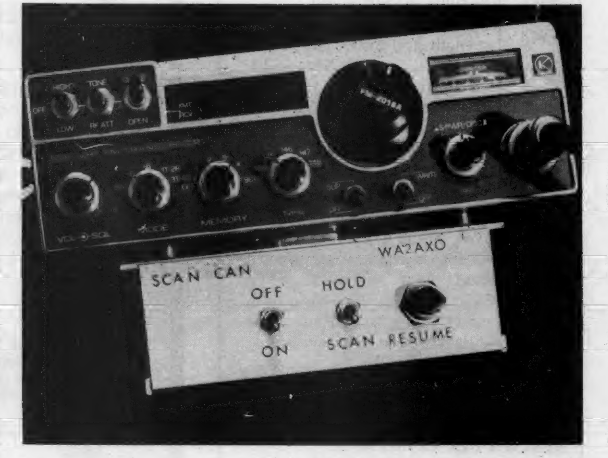

Photo B. The Scan Can mounted in operating position on the KDK.

12 is H, then the counter U4 stops counting and holds. However, when zero volts is on the base of Q1, the counter resumes counting. When the scan function is in the Receive Hold condition and S2 pin 1 is placed to an L, the scan is resumed.

The BCD (Binary Coded Decimal) counter U4 has two separate 4-bit counters. One of the 4-bit counters (whose outputs are labeled A, B, C, and D) is the 10-kHz portion, and the other counter (with outputs labeled E, F, G, and H) is the 100-kHz portion. U3a and U3b are used as a decimal ten and a decimal one-thousand decoder, respectively. When both of the U3a's inputs are H, then pin 3 goes L, providing a clock pulse to the 100-kHz counter, and at the same time, U7a inverts the level and resets the 10-kHz counter to a count of zero. In the same manner, when both of the U3b's inputs are H, then pin 4 goes L and U2b pin 6 goes H, resetting the 100-kHz counter to a count of zero.

U5 and U6 are quad bilateral switches. They can best be described as eight independent single-pole single-throw (SPST) switches. When S3 is in position 3 and at H, then the switches are in the closed position, allowing the levels on the input pins to be present on the output pins labeled A^1 through H^1.

When S3 is in position 1, the outputs of U5 and U6 are switched open and the inputs will not appear on the outputs. This type of circuit is called tri-state logic. The three output-level states are high, low, and high Z.

Construction

The Scan Can shown in Photo A uses wire-wrap IC sockets and has flea clips as terminal pins. These parts are mounted on a perforated Vectorboard® that has the correct spacings for IC sockets. Other methods of interconnections may be employed because the layout of the circuit is not critical.

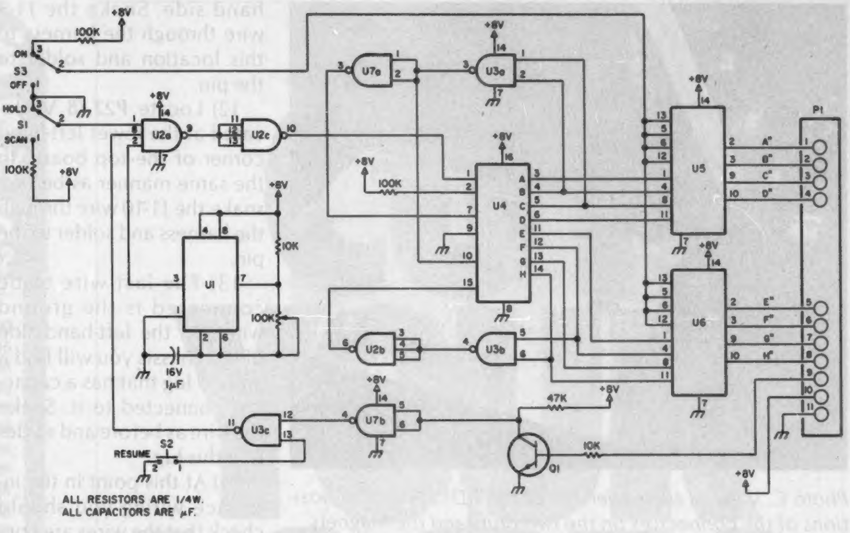

Fig. 1. Schematic of the Scan Can.

A 4¾"-wide by 3"-deep by 1¾"-high utility box was employed to keep the module as small as possible. D-type connectors are used because of their ruggedness and the fact that they can be used as surface-mount connectors. Five ¼" magnets are epoxied to the top of the unit to hold the Scan Can in place while connected to the KDK. This magnet attachment allows quick removal of the module when not in use or when another function module is to be used.

It is always a good idea to buzz out the wiring of the board before going any further in the construction. *Please note*: The CMOS chips used are diode-protected. However, static discharge will damage these ICs. It is recommended that you leave them wrapped in foil until you are ready to install them. After the board is completed, it is mounted in the chassis using ½" spacers. At this time the board is wired to the D connectors and the switches. I used flat ribbon cable to reduce the size of the wire bundle.

Interfacing to the KDK

Interfacing to the KDK is fairly simple and should not be too difficult for those who have worked inside the unit before. The steps taken to wire in the modification are as follows:

1) Remove both the top and bottom covers from the KDK.

2) Unsolder the speaker wires from the bottom cover.

3) With the female D connector as a guide, trace its outline on the front edge of the bottom cover. The connector should be centered ¼" from the edge. Drill holes and file to the shape of the connector. *Note:* leave the rubber pad in place and file through it.

4) Place the connector into the hole, center-punch connector mounting holes, and drill for #4 screws (a #33 drill).

5) Wire connector as per the schematic. *Note*: I used flat ribbon cable for this and the cable should be at least six inches long.

6) Mount the connector with #4-40 screws and feed the cable from the bottom close to the front panel through to the top.

7) Resolder the speaker leads and install the bottom cover.

8) Lift the synthesizer board. There are six screws holding this board down.

9) Locate IC-11 and IC-12 to determine the location of the proper pins that you will be soldering to (see Fig. 2).

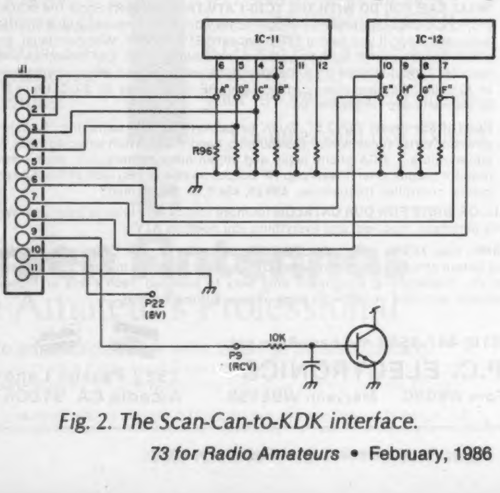

Fig. 2. The Scan-Can-to-KDK interface.

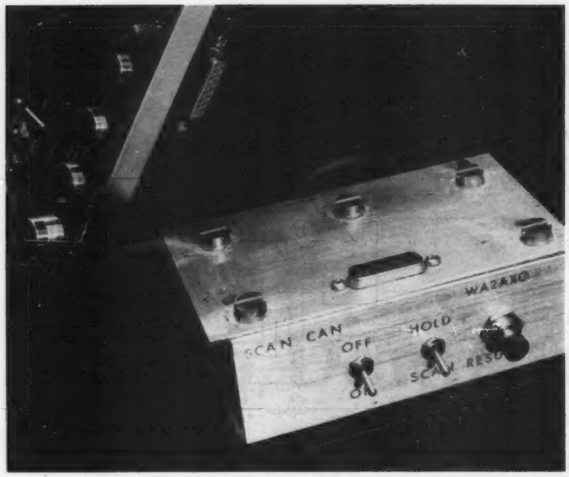

Photo C. View of the underside of the KDK. Note the positions of the connectors on the two units and the magnets.

The wires that go to these ICs are to be lap-soldered to the bottom of this board. Care should be taken that you do not overheat the pads when doing this operation. After you have lap-soldered these eight wires, inspect to see that there is no solder bridging of the adjacent pads.

10) Remount the board, being careful not to pinch the wires that you just connected.

11) Locate P9 (RCV), which is located at the rear of the board on the right-hand side. Snake the J1-9 wire through the harness to this location and solder to the pin.

12) Locate P22 (8 V), located at the lower left-hand corner of the top board. In the same manner as before, snake the J1-10 wire through the harness and solder to the pin.

13) The last wire to be connected is the ground wire. On the left-hand side of the chassis you will find a ground lug that has a capacitor connected to it. Snake the wire as before and solder it to this lug.

14) At this point in the interface wiring you should check that the wires are connected to the correct places, using an ohmmeter. After you have determined that the wiring is correct, remove the screws holding the bottom cover and install the top cover and button up. At this point you have finished the wiring required on the KDK.

Alignment

At this point you are ready to test the unit out. Care should be used when inserting the ICs. It is a good idea to ground yourself when inserting these CMOS chips. After you have inserted them and you are sure that the circuit is wired correctly, you are ready to test.

Connect the unit to the KDK and turn the KDK upside down. Have the cover removed from the module so that you can make some adjustments. On the KDK, set the memory switch to the off position. Set the main dial to zero zero zero on the LED readout. On the Scan Can, set the on-off switch to on and the hold-scan switch to scan. Turn on power to the KDK.

At this point you should see some activity on the KDK's LED readout. If you do not, turn off power and recheck your wiring. If you do have activity, adjust the 100k pot for a scan rate of approximately 100 kHz per second—or to a scan rate of your own liking. Observe that the 10 kHz is stepping from zero through nine and the 100-kHz position also is stepping from zero through nine. When these criteria are met, you are ready to go.

Tips for Operation

Operation of the Scan Can is fairly simple. However, there are tricks I have found that will help you when you operate the unit. I found that to stop on the correct channel every time I had to place the 10-kHz switch on the KDK to the 10s position. The scanner then stops on the right channel. Another thing to know is that your disc switch comes in handy when you are in doubt about the correct frequency. When you turn the on-off switch of the Scan Can to the off position, you can use the main dial as if the unit were disconnected from the KDK. When a signal locks the scanner on hold and you wish to operate on that frequency, set the hold-scan switch to hold. This allows you to transmit and receive on this channel. If you are locked to a frequency that is in use and you wish to resume scanning, press the resume button and the scanner will scan to the next frequency that is in use. ■

Parts List

U1	NE555	Timer
U4	CD4520	Dual binary up counter
U3, U7	CD4011	Quad 2-input NAND gate
U2	CD4023	Triple 3-input NAND gate
U5, U6	CD4016	Quad bilateral switch
Q1	2N2222	Transistor
P1	DA15P	D-type connector
J1	DA15S	D-type connector

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My Yaesu FT-208R synthesized two-meter hand-held was purchased with the idea of making it something of a universal rig. While waiting for the mailman to arrive, I had visions of using it in the car to and from work, from hotels and rental cars on business trips, and even once in a while from my home.

Actual operation from a vehicle for an hour or so each day quickly indicated a couple of things that needed correcting to make mobile life easier; NiCd batteries don't last nearly as long as one might want, and RG-58 coax doesn't make the most flexible of microphone cords (especially on a cold winter morning!).

Speaker/Microphone

The external speaker/microphone (Photos A and B) was the first of the accessories to be built. I must admit to looking long and hard at the factory unit before seriously getting down to the task of construction. The deciding factor, however, was the offer of a free microphone connector by a fellow ham.

Photo A. Completed speaker/microphone. The mike cartridge is the dark circle in the white strip in the middle of the microphone.

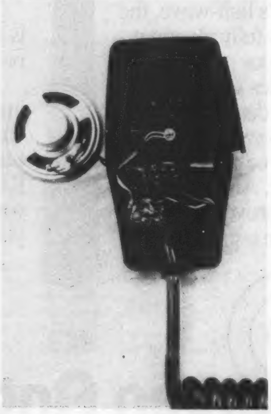


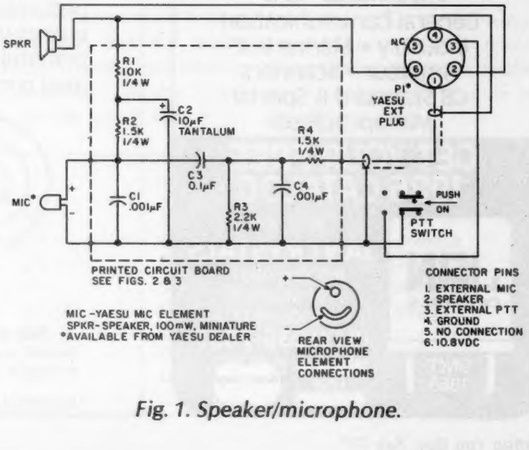
Photo B. Rear view of speaker/mike showing the microphone location. The grommet has been trimmed to allow the speaker to lie flat.

Digging through a box of discarded Citizens Band microphones produced an esthetically pleasing one with a defective cartridge. This same type of mike was used on the KDK FM-144-10SXR and quite a few 27-MHz rigs. A bit of measuring led me to the conclusion that a miniature speaker could, with some careful internal case trimming, produce a nice fit. The old cartridge was discarded and the case halves, screws, and coil cord were cleaned up with warm soapy water for a more presentable appearance.

The speaker was chosen to be close to the outside diameter of the plastic ring which held the original (discarded) cartridge (see Photo B). I used a Dremel-type hand tool with an edge-cutting disk to remove sufficient ring height to let the speaker fit with some looseness between the front and rear case pieces.

A hole of .203-inch (5.2-mm) diameter was drilled completely through the case front. Next, a drill of .234-inch diameter (5.9-mm) was used to partially enlarge the depth of the hole from the inside. Care should be taken not to let the bit pull itself all the way through. This enlarged hole was large enough to accept the new Yaesu mike element as a press fit.

If the drill wobbles and enlarges the hole, a drop of rubber cement, RTV, or other similar removable adhesive can be used to keep the mike in place. A small notch was cut in the case ring to allow the leads from the microphone to pass un-


SPKR
R1
10K
1/4W
R2
1.5K
1/4W
C2
10μF
TANTALUM
C3
0.1μF
C1
.001μF
R3
2.2K
1/4W
C4
.001μF
R4
1.5K
1/4W
MIC*
+
-
NC
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P1*
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PUSH
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PTT
SWITCH
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ELEMENT
CONNECTIONS
CONNECTOR PINS
1. EXTERNAL MIC
2. SPEAKER
3. EXTERNAL PTT
4. GROUND
5. NO CONNECTION
6. 10.8VDC

Fig. 1. Speaker/microphone.

der the speaker rim (via a small grommet).

The speaker leads were soldered to the correct coil-cord leads, and the junctions were covered with heat-shrink tubing. The leads from the mike cartridge as well as the necessary components were soldered directly to the copper areas on the small printed circuit board.

The board was cut and filed for a snug fit in the pocket provided in the front case half for the high/low power switch on the KDK. A scrap of carpet underlay glued to the rear case half keeps the speaker from rattling when the case halves are screwed together.

A small piece of aluminum strip with a .203-inch (5.2-mm) hole in the center is glued to the outside of the front, as shown in Photo A, to hide any drilling mistakes!

The parts are easily obtained. The speaker is a 1.75-inch (45-mm), 8-Ohm, 100-mW general replacement. The mike cartridge is a replacement element for the 207/208 series of hand-helds and is available along with the connector from your Yaesu dealer. Resistors are quarter-Watt, although eighth-Watt could be used. The capacitors (except for the 10 uF, which is tantalum because of the small size needed) are miniature ceramic.

Cigarette-Lighter Adapter

Now that I had an external microphone to make talking easier, I looked at the battery problem. Yaesu was kind enough to include the schematic of a solution in the FT-208R user's manual: a dc regulator circuit to power the unit from the cigarette-lighter receptacle.

My junk box didn't contain the same parts, so I made the necessary changes which are shown in Fig. 4. You will note that I left out the current-limiting resistor and plug that would allow me to charge the battery from the car, preferring instead a home-brew controlled-current charger kept in the shack.

A 15-volt, 1/2-Watt zener has been added to the input for two reasons. Any spikes over the zener voltage will be clipped before reaching the regulator section, and secondly, should the vehicle-battery voltage rise over the 15-volt point, the diode will short circuit and cause the fuse to blow, effectively letting you know that something is wrong and needs attention.

As can be seen from Photo C, the adapter circuit was built on a small piece of PC board 1.5 × 2 inches (38 × 51 mm). This board was mounted on standoffs (three 4-40 screws) in a plastic case that had previously housed a burnt-out ac-to-dc wall adapter.

No PC-board layout is given since the circuit is fairly easy to make by hand with a resist pen. Point-to-point wiring can be used just as well. The heat sink for the pass transistor (TIP42C) is made from a scrap of .062-inch (1.6-mm) aluminum.

Adjustment is simple. Insert the fused plug into a vehicle cigarette-lighter socket. With a VOM connected to monitor the voltage across the output plug, adjust the 1k-Ohm potentiometer for 10.8 volts.

My unit was tested for two hours on continuous one-Amp load. Output voltage dropped by less than 0.3 volts, and the heat sink was only comfortably warm to the touch.

Last Words

While the gadgets described were built for the Yaesu FT-208R, there is nothing to stop anyone from adapting them for many of the multitude of hand-helds out there in vacuum land. Changing the mike element, the connections, and the connector should suffice if your rig uses a similar electret cartridge. If yours takes a standard (non-electret) type, the PC board won't be necessary.

As for the adapter, possibly only a simple adjustment of the potentiometer will be required. The adjustment range with the values shown is from 8.5 to 12.7 volts (with 13.8 volts input).

Synthesized two-meter hand-helds may not be the perfect rig—yet—but a few additional accessories can go a long way towards that goal. ■

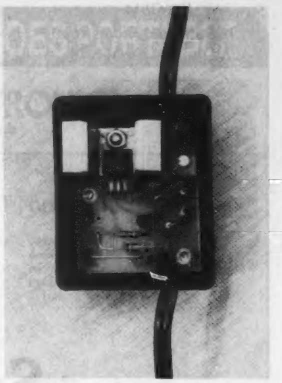

Photo C. Interior view of the dc regulator. The plastic case allowed me to use oversized heat sink for good heat dissipation.

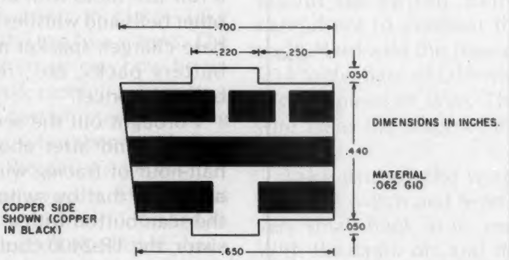
.700
.220
.250
.050
DIMENSIONS IN INCHES.
.440
MATERIAL .062 G10
.050
COPPER SIDE SHOWN (COPPER IN BLACK)
.650

Fig. 2. PC board, external microphone.

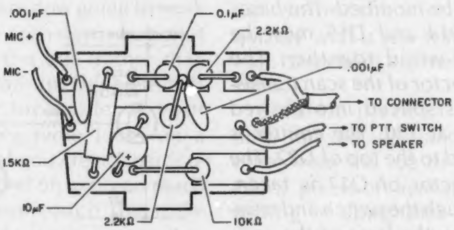
.001μF
MIC +
MIC −
0.1μF
2.2KΩ
.001μF
TO CONNECTOR
TO PTT SWITCH
TO SPEAKER
1.5KΩ
10μF
2.2KΩ
10KΩ

Fig. 3. Parts placement, external microphone.

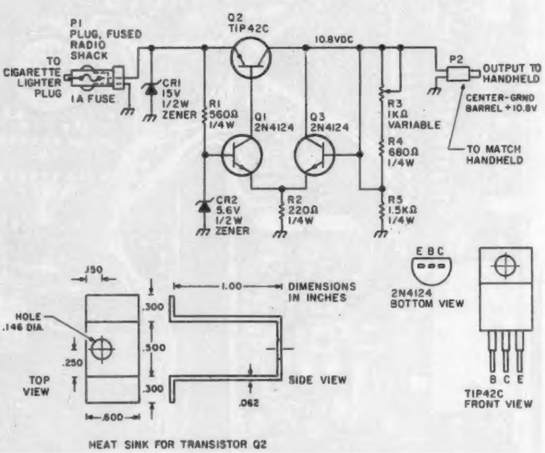
P1
PLUG, FUSED
RADIO SHACK
TO CIGARETTE LIGHTER PLUG
1A FUSE
CR1
15V
1/2W
ZENER
Q2
TIP42C
10.8VDC
R1
560Ω
1/4W
Q1
2N4124
Q3
2N4124
CR2
5.6V
1/2W
ZENER
R2
220Ω
1/4W
R3
1KΩ
VARIABLE
R4
680Ω
1/4W
R5
1.5KΩ
1/4W
P2
OUTPUT TO HANDHELD
CENTER-GRND
BARREL +10.8V
TO MATCH HANDHELD
.150
HOLE .146 DIA.
.250
TOP VIEW
.300
.500
.300
.600
1.00
DIMENSIONS IN INCHES
SIDE VIEW
.062
HEAT SINK FOR TRANSISTOR Q2
E B C
2N4124 BOTTOM VIEW
B C E
TIP42C FRONT VIEW

Fig. 4. Cigarette-lighter adapter.

Steve Wolf NO8M
27132 Butternut Ridge Road
North Olmsted OH 44070

Scanning the TR-2400

A simple mod for lazy hams—push the button and it scans!

My Kenwood TR-2400 handie-talkie has served me long and well. It is an especially nice companion at work, where I drive through the late-night hours. At these times the bands are inactive, and even scanning the ten memories I find my radio time quiet and disappointing. The TR-2400 can be scanned manually by keeping the scan-down button depressed. This can be tedious; it requires your constant attention. For this reason, I began looking longingly at the newer autoscan HTs.

The feature of band scanning would give me just what I wanted. The price of the new HT seemed reasonable, and my TR-2400 could be kept for my darling, almost-licensed wife. But stop and add up the total cost. The HT isn't what gets you—it's the price of the accessories. I might as well buy a full-size radio with all the other bells and whistles. The base charger, speaker mike, battery packs, etc., really boost the price!

I brought out the service manual, and after about a half-hour of tracing wires it appeared that by switching the scan button with a transistor, the TR-2400 could be scanned. All one would need for this project was a switching transistor (2N2222,

Photo by Joseph A. Cilhy

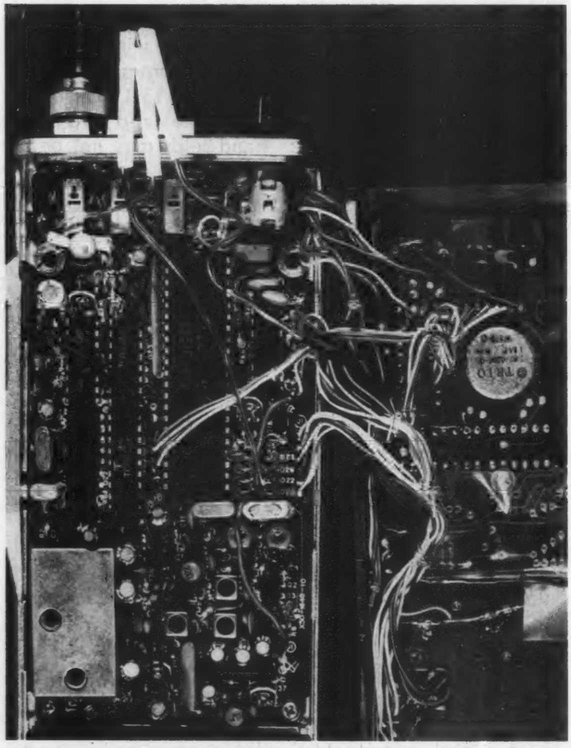

Photo A. Tape all of the leads to avoid a short circuit.

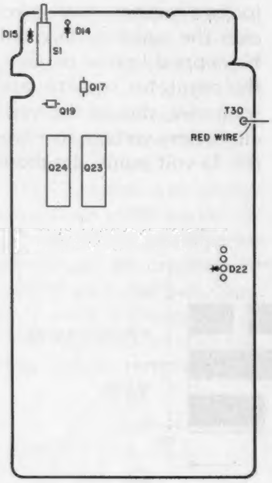

Fig. 1. The PLL board. S1 is the scan-busy switch which is to be modified. The bases of D14 and D15 must be hard-wired together. The collector of the scan transistor is spliced into the red wire at T30. The emitter is wired to the top of D22. The collector of Q17 is taken, through the switch and resistor, to the base of the scan transistor.

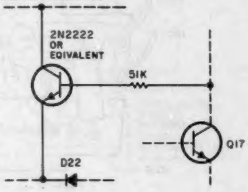

Fig. 2. The entire schematic.

or whatever), a resistor of about 50k, and some wire.

The preparation, however, is a little more complicated. If you have never worked on a synthesized, microprocessor-controlled HT before, read this carefully!

Preparation

1. The day you plan on working on the rig should be your day off.
2. The day before, do whatever it is you do to get all your frustrations out!
3. Reconcile all relations that were severed in the above step.
4. Get a good night's sleep. Don't start on the HT until after you have your coffee, read the paper, etc.

The Modification

This modification is for radios with serial numbers between 006XXXX and 010XXXX. I will describe the steps, and if you have another model you should be able to implement the change without too much trouble.

The front cover needs to be removed first. Remove the battery and take out the two screws in the battery compartment. Leave the two middle screws on the back cover in place. Take out the top two screws. The front cover can now be removed, *carefully*. There is a rat's nest of interconnecting wires, all of them easily broken. Pretend it's a bomb.

Remove the four screws holding the PLL board in place. Pull the board down toward the battery compartment. The board should now be free.

We are now going to work on the scan-down button. I chose this one (rather than the scan-up) because it is easily locatable. If your scanning radio locks on a channel you are not particularly fond of, you can reach over and touch the scan-down button again to bypass that channel. The radio will lower its frequency by 5 kHz each time. Once the squelch closes, the radio will begin scanning automatically.

The schematic showed that by connecting points Y4 and T30 I would have effectively pushed the scan-down button. Y4 can be picked up easily on top of diode D22. T30 is the connection point for the red wire, and I could not locate an easy way to pick up that point. Stripping some insulation back from the red wire provided that connection. Hard-wiring these wires gave me the scan-down for which I was looking.

Now I needed a scan voltage. I could say something brilliant about finding this, but to tell you the truth a VTVM and some poking around was all it took. Pin 36 on the microprocessor is the squelch-suppression input. This is controlled by Q17. The collector of that transistor gave me the low on signal, high on mute, that I needed.

The busy/open switch, a useless entity on my radio, was used to turn the scanner on and off. Take the switch off the board and bend the pins up. Attach two wires to the top two contacts. Remount the switch, being careful not to overheat the pads. Hard-wire the base of D14 to the base of D15 with a short piece of wire. This wire takes the place of the switch.

Take one of the wires from the switch and bend a very small hook in its end. With the radio off and the battery removed, hook this wire onto the collector pin of Q17. This is the *center* pin. Solder the wire very quickly with a low-wattage iron. Don't burn out the transistor.

Solder a piece of wire onto the red wire and another from the top of D22. Put a piece of heat-shrink tubing or spaghetti over these wires and hook them up to the transistor. The wire from the diode is attached to the collector and the wire from T30 is soldered to the emitter. Slide the spaghetti over the connections.

So far, so good. I had to experiment with the resistor in series with the base lead. I finally determined that 51k was the proper value and soldered one to the base lead. The second wire from the switch is then attached to the resistor. Wrap the transistor in tape and place it against Q23 and Q24. If you have been extremely careful, you're ready to button it up.

Very carefully see if you have broken any of the many interconnecting wires. If you have, I strongly suggest you take a nice long break. Have a cup of coffee, watch a program on TV, visit Hawaii. If any of the wires are broken, others will probably be in the way when you attempt to reattach the cover. Do your best.

Be especially careful about the power-supply wires and L101, the choke coming off the battery lead. It is very easy to smoke the radio by pinching one of these wires. I have done this twice now.

Operation

Operation of the scanner is easy. Push the button and it scans. It will stop on a channel if a signal is present. There is no delay; the radio will resume scanning when the signal is dropped.

I have found that the scanner will stop on the center frequency about ninety percent of the time. It rarely stops after the signal has been passed.

With a new Radio Shack transistor (276-2009) at 79 cents and a new 51k resistor at two for 19 cents, the total price comes to 98 cents. Charge yourself $30.00 per hour for labor (the going rate!). Now, take your profit and go out and buy that computer you have wanted. ■

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The RIT Stuff

Clarify your FT-101E's reception with this five-component modification.

The DX bulletin indicated that the newest DXpedition was expected on 20-meter CW about 1300Z. Since working their island would put me one step closer to DXCC, I made a mental note of the frequency and time. When the twenty-four-hour clock turned over to 1300Z, my FT-101E was set and ready to join the pileup. A little tuning found them at 14.028, but the hordes of calling stations were up around 14.035.

Well, a spread of 7 kHz fell smartly beyond the ±5 kHz of the RIT (clarifier) circuitry in my transceiver. After several earlier attempts to move the vfo back and forth to catch a station working split frequency, I had learned it was pretty frustrating. Foiled again! Of course, similar tales of woe can be told about working European stations on 40 SSB, especially during contests. The Europeans cannot use sideband above 7100 kHz, while the American phone subband starts 50 kHz higher. That's really stretching an RIT control.

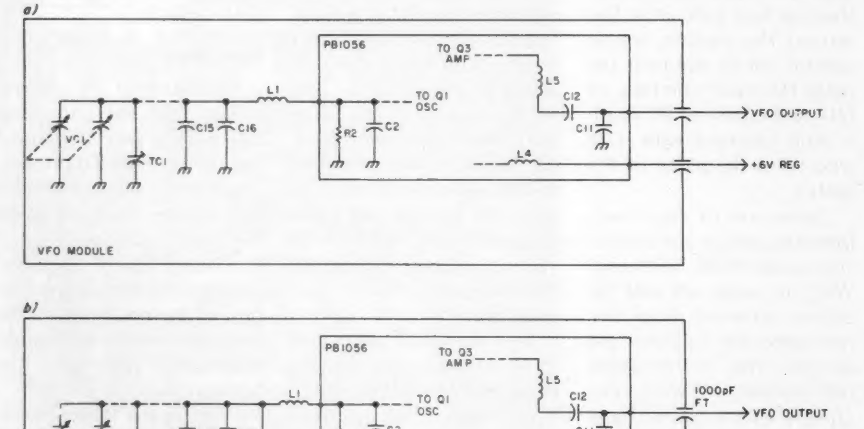
a)
PB1056
TO Q3 AMP
L5
L1
TO Q1 OSC
C12
VFO OUTPUT
VCL
C15
C16
R2
C2
C11
TC1
L4
+6V REG
VFO MODULE
b)
PB1056
TO Q3 AMP
L5
L1
TO Q1 OSC
C12
1000pF FT
VFO OUTPUT
VCL
C15
C16
R2
C2
C11
TC1
L4
1000pF FT
+6V REG
NEW CIRCUIT
C14 6pF
NPO
R1 10K 1/4W
C67 1000pF FT
D1 1S2236
C13 .001μF
Ⓐ
TO PIN 2 FV101 REAR SOCKET
VFO MODULE

Fig. 1. Partial schematic drawings of FV-101 vfo before (a) and after (b) modification to include RIT circuitry. Components on the added board are indicated in (b).

After a few of these situations, it was clear that an external vfo could be very helpful for the kinds of operating that I was doing. Earlier, though, Yaesu had put the FT-101E model out of print, so to speak. This apparently was because of projected problems obtaining the sweep tubes to support their production and replacement requirements. So, I started checking out the used equipment market. I realized quickly that when an FV-101B external vfo did turn up, it inevitably was bought very quickly. In time, though, I managed to find an older version (FV-101) that was intended for the earlier FT-101s. The popularity of this accessory was indicated by the used price being above its original value.

After first checking the unit out, it appeared to work as it should. However, when I set the vfo selector switch to external transceive, I noticed that the RIT control on the FT-101's front panel didn't have any effect. Nor did the RIT circuitry work when the remote vfo was used to control only the receiving frequency. This seemed curious since it certainly is useful to have full RIT capability for both vfos.

Determined to correct the problem, I pulled out the two owner's manuals and studied the schematics for each vfo. This showed that nothing was wrong with my "previously-owned" FV-101. Yaesu simply had not put the RIT circuitry in it. If you examine Fig. 1, you will see that only five components need to be added to the FV-101. The remaining circuitry is contained within the transceiver. None of the components is difficult to get. For your reference, several suppliers are listed in the box. Undoubtedly, there are others as well. The total cost of the components should be around five dollars, assuming that your junk box is empty.

So this became the latest home-brew construction project for me. It seems that the way many of these work out is that what electrically looks like child's play often turns out to be rather involved mechanically. This principally is because the compactness of our modern rigs leaves little room for fingers and tools. Relax, though; much to Murphy's amazement, this modification is a breeze!

What is necessary, of course, is to add the varactor diode (D1) and its associated circuitry inside the remote vfo and connect it to the transceiver. The circuitry itself is not difficult to understand conceptually. A low dc voltage is applied at point A in Fig. 1 (b) by means of a connection to the RIT control on the FT-101E/EE/EX front panel. This voltage is applied to the varactor diode through a current-limiting resistor and this is varied by the setting of the RIT potentiometer on the transceiver's front panel.

A primary characteristic of varactor diodes is that the capacitance across the P-N depletion zone changes with the applied voltage. This capacitance is non-linear and is proportional to the square or cube root of the voltage. The actual capacitance range obtained in this manner is in the order of a few pF depending upon the diode's reverse breakdown voltage and its forward conduction. Those who want to experiment might try using a rectifier diode. If you are interested in reading further about these diodes, a more comprehensive discussion can be found in References 1 and 2. The varactor capacitance, acting together with temperature-compensated series capacitor C14, provides the incremental frequency change as the RIT pot is varied. A relay inside the transceiver is used to disable this circuitry during transmit.

The point that the RIT circuit functions at dc is important because this means that component placement, stray lead capacitance, etc., will not affect performance as they do in many rf circuits. The components that need to be added to the FV-101 (except for the feedthrough, C67) can be mounted on either perfboard or a small PC board. I prefer the latter since it generally allows a neater assembly and has another advantage that we'll get to in a minute.

Parts Suppliers

C13, R1—Radio Shack; Circuit Specialists, Box 3047, Scottsdale AZ 85257.

C67—Semiconductor Surplus, 2822 N. 32nd Street, Unit 1, Phoenix AZ 85018.

C14—Circuit Specialists.

D1—Electronic distributors, e.g., Hatry's, Ledyard Street, Hartford CT. RCA SK3126 & Workman WEP200 are equivalent to the 1S2236. Distributors will also carry many/all of the above components.

The RIT circuitry board is installed inside the vfo module. I found that mounting this board to the removable bottom cover of the vfo module was the most convenient. Access to this cover is gained by removing the cabinet and turning the unit upside down. I used a couple of machine screws and small (¼-inch) metal standoffs for the mounting hardware. The board was positioned near the rear of the cover plate (on the inside). At this point, the extra advantage of the PC board approach becomes apparent. This is simply that the ground connection between the vfo and RIT circuits is automatically established by the PC board's ground foil. Be sure to make this ground connection with a separate wire if you elect to use an unclad perfboard for your work.

A length of hookup wire connects from C14 on the board to the side of L1 that is connected to VC1, etc. Another wire is run from point A to a feedthrough capacitor mounted in the side of the vfo module adjacent to the two existing feedthroughs. In my FV-101, there already was a convenient hole at that point. You may find that it is easier and faster to use a screw-in feedthrough rather than the solder type. Finally, another length of hookup wire connects this new feedthrough to pin 2 on the FV-101 rear socket which was originally unused. This completes the FV-101 circuitry modification and all that was involved was a few components and some wire. Life would surely be easier if all equipment modifications were so straightforward.

The next step involves connecting the remote vfo to the RIT circuitry in the transceiver. Fortunately, this is equally simple. Remove the screw-on cover from both plugs on the remote vfo cable and install another piece of wire inside the cable jacket. This will be easy to do if you use a coat-hanger or such to pull the wire through the vinyl jacket. Then solder the new wire to pin 2 of each plug and put the plug covers back on. This provides a neat cable assembly without any loose wires cluttering your desktop.

Now remove the screws and two small nuts that attach the bottom cover to the transceiver. Solder a wire from pin 2 of the FT-101 external vfo socket to the RIT (clarifier) feedthrough capacitor located on the transceiver vfo module. Be careful, as there are three feedthroughs here. A VOM can be used to identify the correct one since it is the only feedthrough connected directly to the wiper arm (center contact) of the RIT potentiometer. The placement of this wire between the jack and vfo module is not critical.

Prior to putting the FV-101 back in its cabinet, it is necessary to take a moment to align its vfo to the main vfo in the FT-101. The extra added capacitance in the

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circuitry will change the FV-101 frequency somewhat and the actual frequency will not agree with the dial calibration markings. All that is required is a screwdriver adjustment. Initially, both vfos should be checked against the calibrator reference signal in the FT-101.

With the RIT switch off, inject a signal from an rf generator into the radio's antenna connector and zero beat it with the transceiver vfo. Note the frequency on the transceiver's dial and tune the external vfo to the same frequency. The vfo selector switch should be turned to either the External or RX Ext position so that the FV-101 is controlling the receive frequency. Now adjust TC1 with an alignment screwdriver to zero beat the rf generator's signal. There are two alignment capacitors (TC1, TC2) and an access hole for each is provided in the top cover of the FV-101. TC1 is located on the left when viewing down from the front panel of the unit. If a signal generator isn't available, a steady on-the-air carrier signal will suffice.

Well, that completes the entire modification, and the transceiver bottom cover and the FV-101 cabinet can now be replaced. You should find that the RIT control works regardless of which vfo is being used to select the receive frequency. If this is not the case, go back and check your wiring (remember Murphy). Again, be sure that the new RIT circuitry has a common ground with the FV-101 itself. I hope that you will find this modification to be as useful as I have. Good luck in the pileups! ■

References

1. *Radio Communication Handbook*, Fifth Edition, RSGB, pp. 3-12.
2. *Radio Handbook*, 21st Edition, Orr, pp. 20-29.

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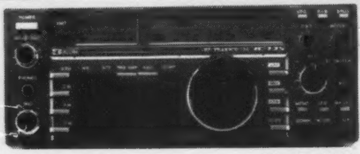

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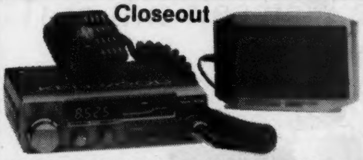

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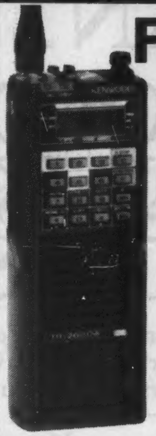

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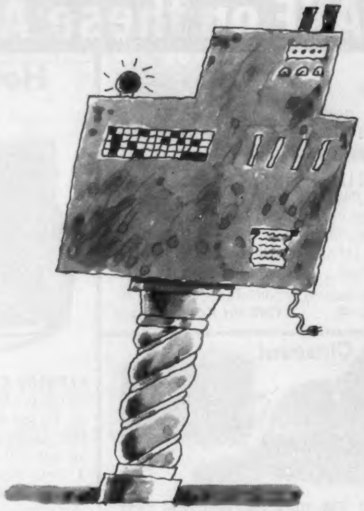

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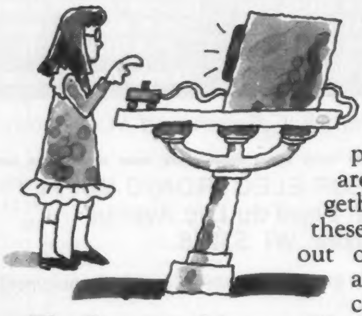
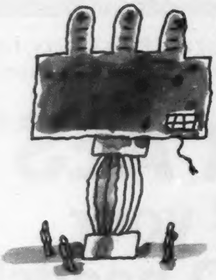


ComputerLand, CW Communications, and The Computer Museum are working together to bring these early relics out of your attic and into the collection of The Computer Museum. The museum is especially looking for kit machines, prototypes, programs, output, newsletters and memorabilia of early computing from around the world. A selection of the finest items will be used to create an exhibit on the evolution of personal computers and a catalog highlighting the Museum's collections. If your submission is accepted for addition to the Museum collection, you will be invited to the grand opening of the exhibit and will receive a bound edition of the catalog. If your item is selected as one of the five best "finds", you will also receive an all-expense-paid trip to Boston for the grand opening party.



So, get up to the attic, down to the cellar and into your closets, and tell us what you find! Call or write the Museum for an official entry form, or send a photo and description of your items by March 1, 1986 to: The Computer Museum, Personal Computer Competition, 300 Congress St., Museum Wharf, Boston, Massachusetts USA 02110, (617) 426-2800, Telex: 62792318.

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Entries will be judged on significance, rarity, date, completness and condition. Items particularly sought include pre-1980 machines, early serial numbers (get those number 1's out), machines made for purchase outside of North America (even modern machines are sought in this category); first releases of software such as first releases of operating systems, languages and mass-marketed and original applications; and pre-1980 photographs, newsletters, manuals and other records. The Computer Museum is a private non-profit educational institution. All donations are tax-deductible according to the provisions of the Internal Revenue Service. Thinker Toys is a registered trademark of George Murrow & Murrow Designs, Inc.

Rebirth of the Eico 221

Turn this flea-market regular into a super-sensitive voltmeter. Then count the money you saved.

Dick Dreher W5VTJ
12645 E. 31st Court
Tulsa OK 74145

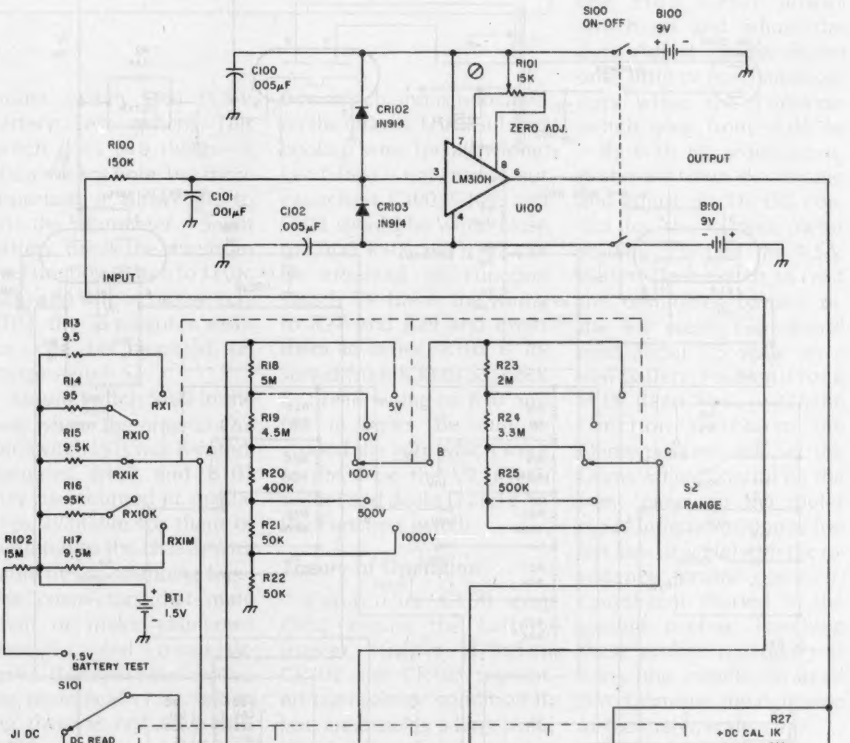
S100 ON-OFF
B100 9V
C100 .005µF
R101 15K
CR102 IN914
ZERO ADJ.
R100 150K
C101 .001µF
LM310H
U100
CR103 IN914
C102 .005µF
OUTPUT
B101 9V
INPUT
R13 9.5
R14 95
RX1
RX10
R15 9.5K
RX1K
R16 95K
RX10K
R102 15M
R17 9.5M
RX1M
R18 5M
R19 4.5M
R20 400K
R21 50K
R22 50K
5V
10V
100V
500V
1000V
R23 2M
R24 3.3M
R25 500K
S2 RANGE
BT1 1.5V
1.5V BATTERY TEST
S101
J1 DC
DC READ
J2 AC-OHMS
J3 COMMON
-DC
+DC
OHMS
AC
A
B
C
D
E
R26 5.6M
C3 .01µF
CR100 IN4005
CR101 IN4005
R103 1K
R104 20M
C4 .01µF
R106 680Ω
OHMS ADJ. R28 1K
M1 0-1mA=F.S.
+DC CAL R27 1K
R107 680Ω
R29 1K
-DC CAL
S3 FUNCTION
R105 3.3K
R30 1K
AC CAL.

Fig. 1. Meter after conversion.

If you have scanned the meter pages of electronics catalogs lately looking for a meter with high sensitivity, you quickly become "sensitive" to high prices. Most ham auctions and sales usually will yield an Eico 221 for about five bucks. Mine cost low, as the transformer was scorched.

This conversion permits very sensitive measurements at 10 megohms per volt in solid-state circuitry and applications where ac power for a VTVM is not readily available (such as mobile gear, etc.). Though unable to measure current as some VOMAs and DVMs, its cost and sensitivity offset this shortcoming.

Mike Kaufman K6VCI did a good job on his article in *Ham Radio Magazine*, December, 1974 ("How to Convert Your VTVM to an IC Voltmeter"). He shows you how to convert the Heath IM-11. In comparing his arti-

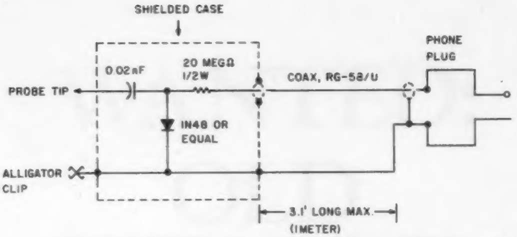
SHIELDED CASE
PHONE PLUG
0.02μF
20 MEGΩ 1/2W
COAX, RG-58/U
PROBE TIP
IN48 OR EQUAL
ALLIGATOR CLIP
3.1' LONG MAX. (1METER)

Fig. 2. Rf probe circuit.

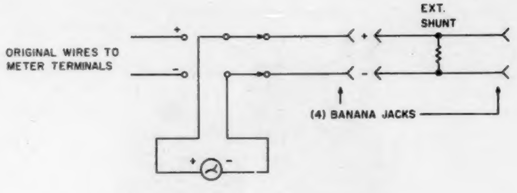
EXT. SHUNT
ORIGINAL WIRES TO METER TERMINALS
+
-
(4) BANANA JACKS

Fig. 3. Milliammeter circuit.

cle with converting the Eico 221, I noticed some differences.

This article will show you how to enjoy the original features of the Eico 221, yet have a meter that is totally battery-operated. Conversion is relatively simple for the average builder-hobbyist.

Fig. 1 shows the meter after conversion. It would be helpful to have the original construction manual when doing the modifications. I didn't enclose photos of the conversion as the text is fairly descriptive.

Note the parts in Fig. 1 designated "100" as "U100". These are new parts you add. Most are available from Radio Shack, Poly Paks, etc. See the parts list for descriptions.

This conversion is begun by removing unnecessary components. See your Eico 221 book for parts locations if they are not clear. Parts with an asterisk (*) are on the Function switch, S3. Remove (and put in your junk box): The ac line cord, On-Off switch (S1), power transformer (T1), pilot lamp (B1) and holder, all tubes (V1-V3), resistors R1 (10k, 2 W), R2 (33k, 2 W), R3 (20k), R4 and R6 (1.5 megohms), R7 (5 megohms), R8* (1 megohm), R9 (5 megohms), R10 and R11* (1k), capacitors C1 and C5* (0.002 μF), C2 (filter), and C4* (0.01 μF). Save C4* for conversion. Also remove potentiometers R5 (2 megohms, Ac Zero Adjust) and R12 (2k, Zero Adjust).

Install R101 (15k) in the front panel hole where R12 was. If you strip the chassis clean, except for adjustment pots and their wiring, you removed all of the above parts. Do not disturb the wires on or to Function or Range switches at this time. Cut any of the wires from these switches at the chassis end and tag them as to original connections. If you use the tube sockets for the new circuit, leave them as is. Enlarge the hole in the panel where the pilot lamp holder was to 1/2-inch (12.7mm) diameter and

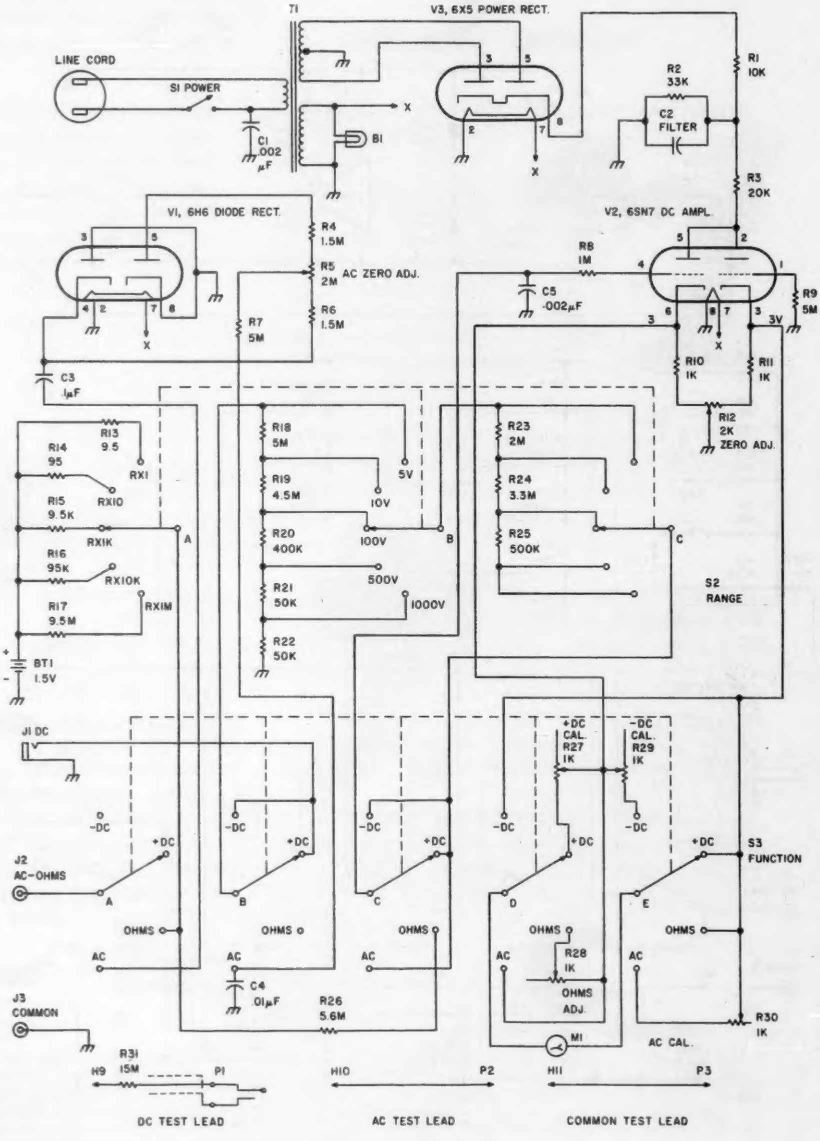
T1
V3, 6X5 POWER RECT.
LINE CORD
S1 POWER
C1 .002 μF
B1
R1 10K
R2 33K
C2 FILTER
R3 20K
V1, 6H6 DIODE RECT.
R4 1.5M
R5 2M AC ZERO ADJ.
R6 1.5M
R7 5M
V2, 6SN7 DC AMPL.
R8 1M
C5 .002μF
R9 5M
3V
R10 1K
R11 1K
R12 2K ZERO ADJ.
C3 .1μF
R13 9.5
R14 95
R15 9.5K
R16 95K
R17 9.5M
RX1
RX10
RX1K
RX10K
RX1M
BT1 1.5V
R18 5M
R19 4.5M
R20 400K
R21 50K
R22 50K
5V
10V
100V
500V
1000V
R23 2M
R24 3.3M
R25 500K
A
B
C
S2 RANGE
J1 DC
J2 AC-OHMS
J3 COMMON
+DC CAL. R27 1K
-DC CAL. R29 1K
-DC
+DC
OHMS
AC
C4 .01μF
R26 5.6M
R28 1K OHMS ADJ.
M1
R30 1K AC CAL.
S3 FUNCTION
D
E
R31 15M
H9
P1
H10
P2
H11
P3
DC TEST LEAD
AC TEST LEAD
COMMON TEST LEAD

Fig. 4. Meter before conversion.

Parts List

B100, B101	9.0-volt transistor battery with connectors (battery holders optional)
C100, C102	0.005-μF, 50-volt mica
C101	0.001-μF,50-volt mica
CR100, CR101	1N4005 or equivalent 600-piv,1-Amp diode
R100	150k, 1/4 W, 10%
R101	Pot. 15k, 1/2 Watt, panel-mount type
R102	15 meg, 1/4 Watt, 10%
R103	1k, 1/4 Watt, 10% (can use old R10 or R11)
R104	20 meg, 1/4 Watt, 10% or (2) 10 meg, 1/4 Watt, 10% in series
R105	3.3k, 1/4 Watt, 10%
R106, 107	680 Ohms, 1/4 Watt, 10%
S100	toggle switch, DPST
S101	toggle switch, SPDT
U100	IC, National Semiconductor LM-310H voltage follower

mount switch S101 (1.5-V Battery Test switch). This switch does two things—it fills a vacant hole, but more important, it allows you to test the ohmmeter 1.5-volt battery. Break the wire from the Function switch to J1 (dc jack) and wire in this switch. R102, the 15-megohm resistor, can be mounted on Range switch S2.

Mount switch S100 in the hole where the original On-Off switch (S1) was located. Batteries B100 and B101 may be mounted in special clips available for them or mounted to the chassis with cable ties or strapping tape. Use connectors that mate them or make your own from discarded 9.0-volt batteries. Batteries need replacing periodically, so soldering them is not advisable. U100 can be soldered into one of the existing tube sockets or push out one of the transformer grommets and insert a round nylon 8-pin IC socket in the hole and wire to the socket.

All remaining parts may be wired to the two remaining sockets or mount to some 3-lug solder strips mounted on the chassis. A perforated Vectorboard® could also be used. This part of the conversion is mostly left up to the hobbyist's ingenuity. C4 was on the Function switch and is relocated on the chassis. Use insulated hookup wire for all wiring. Lead dress is not critical, but capacitors C100, C101, and C102 should be wired close to U100. R106 and R107 can be mounted on Function switch S3. Break the wiring to R27 and R29 and insert them in series. R105 is inserted from R30 to S3, deck E. Break wiring to R30 and put in series. Be sure to ground the wire which went to pin 3 on the V2 (6SN7) socket and decks D and E on the Function switch.

Theory of Operation

Capacitors C100 and C102 bypass the battery power supply. Diodes CR102 and CR103 prevent an overvoltage condition if you are probing a large voltage while the meter is switched to a low-voltage range. They limit voltage on U100, pin 3 to ±9.0 volts dc. Resistor R100 limits current into CR102 and CR103 and forms part of the protective circuitry. Capacitor C101 keeps any ac out of U100's input. Its value is not critical except increasing its value will increase the measuring time. Potentiometer R101 is the new Zero Adjust pot.

Diodes CR100 and CR101 replace the original 6H6 diode circuit. They should be at least 600-piv, 1-Amp types. CR100 clips the negative half of the cycle to ground after coupling through capacitor C3. CR101, R104, and R103 "steer" the positive half of the cycle to the Function switch and Range switch circuit as dc input does. C4 bypasses any stray ac to ground.

Calibration

With unit power off and the S101 1.5-V Battery Test switch set to Dc Read, adjust the mechanical zero screw on the meter until the needle points to zero. Turn the S100 meter power switch on and adjust the Zero Adjust control (R101) until little or no change occurs when the Function switch goes from +dc to −dc with no probe input. Probe a known dc voltage and adjust the Dc Cal control for the correct meter reading. Position the 1.5-V Battery Test switch to read the ohmmeter battery on the 5-V scale. You should read about 1.5 volts on a new battery. Position it back to Dc Read. Next, switch the Function switch to the Ohms position and set the Ohms Adjust control on the front panel so the meter reads infinity resistance (on left side of scale) with the resistance probe open-circuited (not shorted to the ground probe). Touching these probes together will bring the needle to read zero Ohms on the right side of the meter scale.

Never leave the meter in the Ohms position or S101 in the 1.5-V Battery Test position as the latter disables the meter from reading dc and the first is normal procedure. The battery could drain over a few months. Finally, put the Function switch in the Ac position and adjust the Ac Cal pot until a known ac voltage reads correctly on the meter. Caution: Do not use the ac line to calibrate this meter as one side of the line will always be on the panel and chassis and a serious shock could result. A suggested method is to use a 6.3-V-ac transformer and calibrate the meter on the 10-V-ac range, comparing the reading with a known good meter.

Always turn this meter off when not using it, as the LM-310H draws about 4 mA and will consume the batteries in a period of time. An LED Power On indicator would consume 20 mA from the power supply, so it was not part of this conversion.

Another useful application in ham radio for this conversion is to use an rf probe into the ac input and measure relative power output and antenna field strength. A short piece of wire or a clip lead on the end of an rf probe will pick up enough rf energy to give a good reading. Eico had a model PRF-25 probe available for this VTVM, or a simple probe may be made with a 1N48 diode, a 0.02-μF, 600-V capacitor, and a 20-megohm, 1/2-Watt resistor in a shielded tube or enclosure. See Fig. 2.

If you still need a milliammeter, the basic movement here is 0-1 mA dc full scale. Mount a DPDT switch on the front panel and wire the meter terminals to the common contacts. Wire two banana jacks to the normally-closed contacts and connect the two original meter wires to the normally-open contacts (see Fig. 3). The banana jacks could be mounted on the back of the cabinet. Of course, the main on-off switch stays off to use the 1-mA function. By experimenting with resistor shunts across the banana jacks, this 1-mA range can be extended to several Amps. Start with about 90 Ohms and go as low as 0.1 Ohms and compare the reading with another milliammeter in series with this meter between a dc power source and a load. With the proper shunt, this meter should track the known meter. ■

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Netherlands

Super-Selectable Bandpass Filters

PA0SE uses extraordinary methods to craft the ultimate i-f filter.

It is very convenient when the bandwidth of a ham receiver can be adapted for different circumstances. That is to say, to the kind of signal to be received—telephony, telegraphy, RTTY, FAX, etc., and to the interference caused by other stations which, especially on the HF bands, is practically unavoidable.

Commercial receivers and transceivers sometimes offer the possibility of selectable bandwidth. That is realized by providing several i-f filters with different passbands that can be selected by a switch. In order to keep the initial price low, often a single filter is built in as standard and the extra filters can be ordered separately for a considerable amount of money. The price of i-f filters is the reason that even the "deluxe" transceivers and receivers usually provide only limited choice of bandwidth.

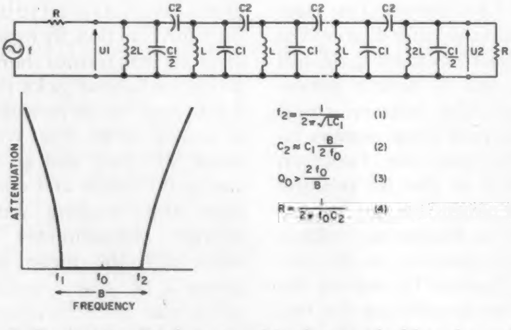
For the home-brewer who constructs a modern receiver with a high intermediate frequency, say over 4 MHz, the possibilities are no different than those for the professional designer. He, too, must buy a separate, expensive bandpass filter for every value of bandwidth desired. It is in principle possible for the amateur to make his own crystal filters, but this remains a tricky business and it is difficult, if not impossible, to realize a predictable bandwidth.

But there is a different way. We can construct a multi-resonator bandpass filter using coils and capacitors on a relatively low i-f—50 kHz for instance. It is not difficult to make the passband width of such a filter switchable to as many different values as we desire. Such a low i-f dictates the use of double- or triple-frequency conversion in a superheterodyne receiver for the HF bands in order to retain a reasonable attenuation of image responses. That may seem a bit outdated, but when the receiver is carefully designed, this should not pose insurmountable problems. Even in some famous commercial receivers, like the Drake, this system is used.

For my own ham-shack receiver, which I constructed some seventeen years ago, I followed this approach using a final intermediate frequency of 50 kHz. This receiver still copes fully with conditions on the amateur bands of today. The original filter was made with seven capacitively-coupled resonant circuits, and the passband was 2.7 kHz wide.

That was OK for single sideband, but for other modes, like CW and teleprinting with the "hell" system (see Hans Evers PA0CX (DJ0SA), "The Hellschreiber, A Rediscovery," *Ham Radio*, December, 1979), I began to feel the need for some smaller bandwidths. That was the reason I replaced the seven-circuit bandpass filter with fixed passband by an eight-circuit one having selectable bandwidth. Together with passband shift, this gives me the capability to match the receiver bandwidth to the actual receiving conditions in an optimum way. This filter is the subject of this article.

It may be of interest that I use a similar filter in my homemade single-sideband transmitter for the bands 10 to 160 meters. That filter employs six tuned circuits on about 20 kHz. Sideband and



$$f_2 = \frac{1}{2\pi\sqrt{LC_1}} \quad (1)$$

$$C_2 \approx C_1 \frac{B}{2f_0} \quad (2)$$

$$Q_0 > \frac{2f_0}{B} \quad (3)$$

$$R = \frac{1}{2\pi f_0 C_2} \quad (4)$$

Fig. 1. Basic circuit of a capacitively-coupled bandpass filter.

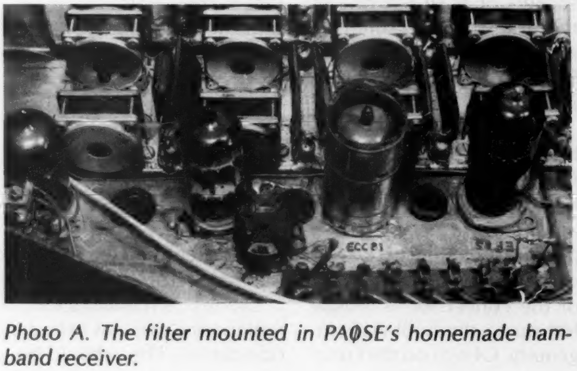


Photo A. The filter mounted in PA0SE's homemade ham-band receiver.

carrier suppression are extremely good and stable and the quality of the SSB signal can successfully compete with any modern conception.

Principle and Design—A Switchable I-f Filter

The principle of an LC filter with capacitive top coupling is indicated in Fig. 1. At the left is shown how the passband is defined as the frequency difference between the upper limit, f_2, and the lower limit, f_1. f_0 is the so-called central frequency. The band between f_1 and f_2 is called the passband with width B.

Modern filter theory permits one to design a bandpass filter using this configuration with predictably exact characteristics. That is to say, we can prescribe f_1 and f_2 and also the slope of the transitions between the passband and the stopbands below f_1 and above f_2.

The values for coils and capacitors can be found by computation and also in recipe books for filters. But the awkward thing about it is that all coils and capacitors usually end up with different and odd values for self-inductance and capacitance—37.21 pF and 9.82 mH or so, for instance. When the passband width should be switchable, the situation becomes even more embarrassing because the values of all coils and capacitors have to be changed.

It is easier, therefore, for the amateur constructor to design the filter according to the classical "image-parameter" method. The disadvantage of this approach is that the filter characteristics cannot be predicted exactly when using non-ideal components and filter terminations. Also, the transitions between pass- and stopbands will be less steep than for an optimal filter designed using modern filter theory. But the pleasant aspect of an image-parameter filter is that all filter sections except the first and the last are similar.

Fig. 1 is applicable, too, for a filter designed by classical filter theory. All coils have the same self-inductance value, L, except the first and the last coil; these have 2L. Also, all parallel capacitors are similar with value C_1, except again for the ones in the end section which are of value $C_1/2$. Coupling capacitors C_2 are all similar, and they determine the width of the passband.

Let us now take a look at the formulas in Fig. 1. The first shows that upper limit f_2 of the passband is determined by the resonant frequency of the parallel tuned circuits on their own. That is, L in parallel with C_1 for the intermediate sections and 2L in parallel with $C_1/2$ for the end sections.

At lower passband limit f_2 each coil resonates with the total capacitance connected to it: for the intermediate circuits, L in parallel with $C_1 + 2C_2$, and for the first and last section, 2L in parallel with $(C_1/2) + C_2$.

With some approximations, the second formula can be derived from this, allowing us to compute C_2 for a desired bandwidth, B. As already stated, this is an approximation: The actual bandwidth obtained can deviate considerably from the computed one. It is useful as a starting point, however, and the actual value for C_2 necessary for a certain bandwidth, B, can be found quickly enough by experiment.

The third formula is an important one. It indicates the minimum circuit Q_0 required in order to obtain a certain bandwidth. The narrower the passband desired, the higher Q_0 has to be. This shows why we cannot construct the filter for a high intermediate frequency. Say that we want B to be 2.5 kHz and $f_0 = 9$ MHz. The minimum circuit quality, Q_0, in this case has to be $(2 \times 9000)/2.5 = 7200$. No coil will ever be that good, but quartz-crystal resonators are, and these indeed are used in such i-f filters.

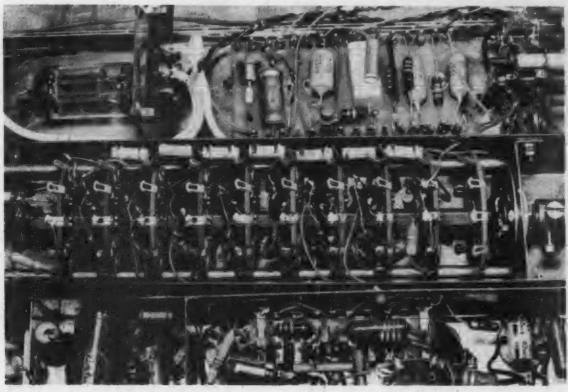


Photo B. View of the filter from the bottom of the receiver. Coupling capacitors and loading resistors are mounted directly on the switch decks.

So we should start by making the best coils we can at the chosen intermediate frequency, f_0. (The Q of the capacitors is usually so much higher than that of the coils that Q_0 of the circuit is set by Q_0 of the coils alone.) For the frequencies concerned, we have to make use of ferrite pot cores and Litz wire. The ferrite should be suitable for the frequency we want to use. The bigger the pot core, the higher Q_0 becomes. Also, we should try to fill the space inside the pot core completely with the winding. How the Q of the circuit can be measured will be shown later.

For my own filter, with f_0 about 50 kHz, I used 1-inch ferrite pot cores of Philips manufacture. It is a now-obsolete type, designated as K300063. The coil has a slug for fine-tuning. No doubt suitable ferrite pot cores of other manufacture can be obtained outside my country.

I tried several types of Litz wire from my junk box, even home-brew, made by twisting two insulated 0.25-mm (30 AWG) wires. But the highest Q was obtained by using 28 × 0.05 Litz wire (28 strands of 0.05-mm diameter) that was kindly provided by PA0LQ from his personal store. Q_0 varies a bit from coil to coil but is of the order of about 370.

We now know the minimum passband width we can obtain, because from the third formula comes $B_{min} = 2f_0/Q_0$, and $2 \times 50000/370 = 270$ Hz. We can get even narrower passbands, but the insertion loss in the passband then increases quickly. The tuned circuits become undercoupled—something you may remember from the theory of double-tuned circuits.

Finally we have the fourth formula. That one states that the end sections of the filter shouuld be loaded by a resistor the value of which is equal to the reactance of the coupling capacitors, C_2. This is not very critical. We may use a somewhat greater value for R than the formula prescribes, but if we go too high, ripples in the passband appear. We should also realize that the loading resistor, R, assumes theoretical, that is, lossless, coils. In the real world coils do have losses, and the losses in the first and the final coil already provide some of the loading. This implies that at the narrowest bandwidth the external loading resistors can be omitted, as all loading is already provided by the "loss

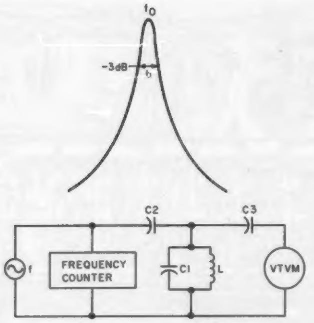


Fig. 2. How unloaded quality factor Q_0 is measured.

resistance" of the coils themselves.

Making the Filter

How do we make the actual filter we would like to possess? That is largely dictated by what your junk box provides in the way of capacitors of equal values. I assume you already possess or can obtain suitable ferrite pot cores. When we start by fixing C_1, then L is set as well, according to formula one. We now try to obtain the correct L with wire that fills the coil form as much as possible. (Note that the end coils have double the self-inductance!) If the choice of Litz wire is limited, we can also start by making the coils, filling the coil forms completely. The self-inductance, L, is then measured, and from this follows C_1.

Capacitors C_1 should be of good quality, mica or polystyrene. A small tolerance of capacitance value is nice to have but is not a must. We have to tailor the number of turns for each individual coil, anyway. Differences of up to 10% between the individual coils and capacitors do no harm as long as each parallel circuit can be tuned exactly to f_0.

I had a small batch of 2.5-nF mica capacitors for the intermediate sections. For the end sections, the capacitors should therefore be 2.5/2 or 1.25 nF, but those were not available. The junk box did provide capacitors of 1.35 nF, however, so these were used. The self-inductance of coils 1 and 8 had to be corrected for this, of course. The coils for intermediate sections 2 through 7 worked out at a self-inductance of 3.74 mH. That is a value I calculated after completion of the filter because, as stated already, the coils are individually tailored to the capacitors they are used with.

We start by putting in more turns than are necessary (according to the formula provided by the maker of the pot cores for obtaining a certain value of self-inductance). The coil is now temporarily assembled without the tuning slug. We now rig up the circuit of Fig. 2. C_1 is the capacitor that will be used with the coil under construction. C_2 and C_3 are as small as possible consistent with a reliable indication on the VTVM (a scope can also be used).

We now tune for resonance, as indicated by a maximum of the voltage over the circuit. This is very sharp! The frequency of resonance will usually be lower than f_2 as defined in Fig. 1. We now remove one or two turns of the coil and measure again. (That sounds worse than it is: The wire removed is simply left in the circuit; it has negligible influence on the frequency of resonance.) During the measurement, I simply press the two halves of the pot core together by hand.

We go on taking off turns until the resonance frequency is just slightly higher, say 2%, than f_2. We now can finally assemble the coil and insert the slug. If all is well we can now tune neatly around f_2.

It all sounds a bit complicated, but is the only method that guarantees tuning the circuits properly to the correct frequency. Only when you are lucky enough to have very small tolerance capacitors available (1% or better) can you wind all coils with the same number of turns, as calculated for your particular pots to reach the required self-inductance. The reason is that the slug permits only a small variation of the coil's self-inductance—some 2% or so.

In this way we proceed for all the tuned circuits, eight in my case. When the tuned circuits are ready, we can mount them on some suitable support. How you do this is not so important. But try to do it in such a way that input and output of the filter are well separated; otherwise some signal may bypass the filter in the stopbands. I used a kind of channel made of tin-plate—as can be seen in the photographs. The coils and the parallel capacitors are mounted on top; the switch and the coupling capacitors are inside the channel.

The complete circuit diagram of the filter is shown in Fig. 3. The number of different passband widths that you put in is up to you. It will probably be determined by the kind of switch you have available and the number of equal-valued capacitors in your junk box. I had a 12-position switch of which 10 positions are used.

As you can see in Fig. 3, there is a small capacitor, 3.3 pF in my filter, always in circuit. This was provided for alignment purposes. It is convenient when all circuits can simply be tuned to maximum on a test signal.

We can find a suitable value for the small coupling capacitor as follows. From the measured Q_0 of the coils, find the minimum passband width possible using the third formula. Entering this bandwidth, B, into the second formula then gives you the corresponding C_2. If you now take half of this value for the capacitor that is always in circuit, you will be OK. When the small coupling capacitors have been put in, we can start aligning the filter.

We need some indicator, like a VTVM or a scope, and we couple it lightly to the last circuit, number 8 in my case. Coupling can be done via a small capacitor. We also need some generator that is tuned to upper frequency limit f_2 of the filter passband. The generator is connected in parallel with circuit 7. It does not matter if this circuit is heavily damped by the generator. We now tune circuit 8 for maximum voltage.

Next, the generator is moved to circuit 6 and number 7 is tuned for maximum voltage. Then the generator is moved on to circuit 5 and circuit 6 is tuned for maximum voltage, and so on. If the signal on the last circuit becomes too weak for a reliable indication, we move the indicator to number 7 or 6. So we finally come to circuit 1.

The generator is now lightly coupled to 1 via a small capacitor in order not to detune it under the influence of the generator. When circuit 1 is also peaked, alignment is completed for circuits 2 to 7. We can fix the slugs with wax to make them stay put. Circuits 1 and 8 will get a final touch-up once the filter is mounted in the receiver to compensate for the capacitance of the stages preceding and following the filter.

Now you can start putting in the coupling capacitors for the switch positions you are going to use. It is simply a matter of soldering them

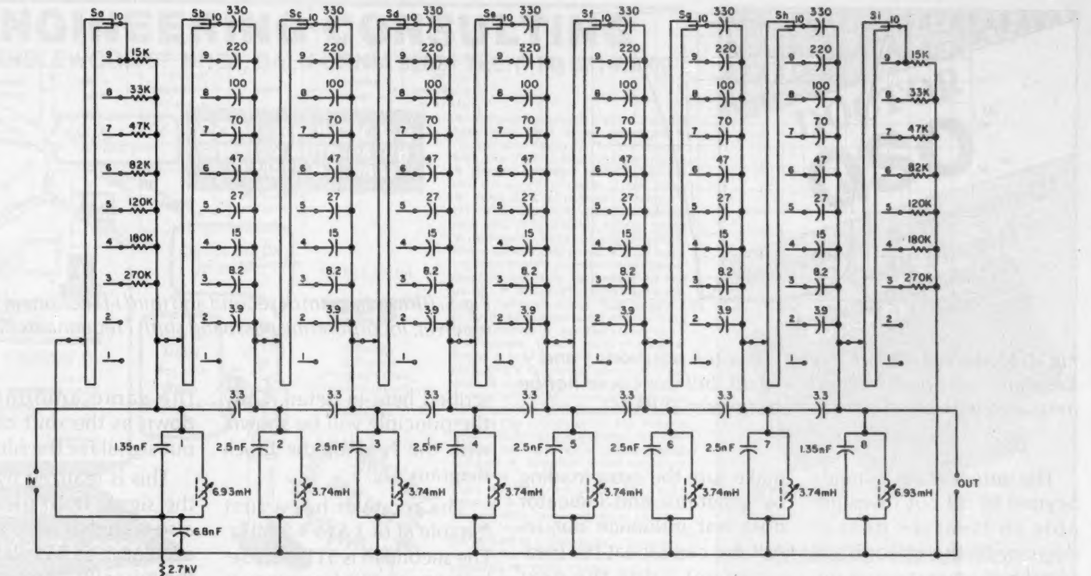


Fig. 3. The actual circuit diagram of the filter with selectable bandwidth. Capacitor values in picofarads unless designated nF (nanofarads). Sa through Si are the decks of the bandwidth-selector switch.

directly to the switch contacts and seeing what you get in the way of passband. No further alignment is necessary. In Fig. 3 you can see what I used, and Table 1 gives you the results I obtained. Position 1 gives the smallest bandwidth, 132 Hz, and this is with only the 3.3-pF capacitors in place. As stated, this switch position is intended for alignment only, but in practice it turned out to be useful as an operational position as well.

Switch decks Sa and Si are used to connect the proper loading resistors in parallel with the first and the last circuit. The values of these resistors can be found easily; they are equal to the reactance of the total coupling capacitance, C_2, in effect at each switch position. For positions 2 and 1, no resistor is required as the loss resistance of the coils themselves provides the loading.

You see that the resistors become smaller as the bandwidth increases. This means that the input resistance of the filter, as "seen" by the stage driving it, also decreases. And since the amplification of the stage feeding the filter is equal to the mutual conductance of the tube or transistor multiplied by the input resistance of the filter, this amplification also decreases as the filter bandwidth becomes wider. This effect is slightly compensated for by the fact that the insertion loss of the filter goes down as the circuits become more tightly coupled, but this compensation is only small because this filter loss is only of the order of one dB for the wider bandwidths.

This effect is also shown in Table 1. The total amplification between the input of the stage preceding the filter and the output of the filter was measured for the different switch positions. The amplification in switch position 2 was put at 0 dB as a reference. The table shows what happens in the other positions. Actually, the value in position 10 should be more than −21 dB, but I chose to use the same loading resistance, 15k Ohms, for positions 9 and 10 in order to keep the total amplification from going down too much. The underloading in position 10 is noticeable as a slight ripple in the passband that does no harm.

I first intended to make the total amplification the same for all switch positions by switching in suitable resistive attenuation networks on the output side, and I reserved a switch deck for that purpose. It is the one nearest the front panel of the receiver in Photo B. But I finally rejected that refinement. The difference in receiver gain is hardly noticeable under the compensating influence of the automatic gain control. Only if you would like to have the S-meter calibration hold for all switch positions should you include the loss equalization. My S-meter is used only as an uncalibrated indicator.

Table 1 gives the measured bandwidth at −6 and −60 dB with respect to the maximum in the passband. From that, the shape factor is computed and it approaches 1.7 when the bandwidth is 2.70 kHz or wider. A very good figure, I think.

The shape of the filter attenuation characteristic was also measured. Fig. 4 shows two of the curves, for switch positions 5 (1.11 kHz) and 9 (7 kHz). It is shown clearly that the upper limit of the passband remains at about 52 kHz and the lower limit moves down as the bandwidth increases.

Position of the switch	1	2	3	4	5	6	7	8	9	10
Bandwidth at −6 dB (passband)	132 Hz	177 Hz	361 Hz	638 Hz	1.11 kHz	1.91 kHz	2.70 kHz	3.64 kHz	7.03 kHz	9.36 kHz
Bandwidth at −60 dB	580 Hz	715 Hz	1.04 kHz	1.50 kHz	2.20 kHz	3.41 kHz	4.71 kHz	6.32 kHz	12.2 kHz	16.0 kHz
Shape factor B_{60} dB/B_6 dB	4.4	4.0	2.9	2.3	2.0	1.8	1.7	1.7	1.7	1.7
Attenuation at f_0 with att. in pos. 2 as reference	−7.0 dB	0 dB	−6.5 dB	−5.5 dB	−6.5 dB	−8.5 dB	−12 dB	−15 dB	−21.5 dB	−21 dB

Table 1.

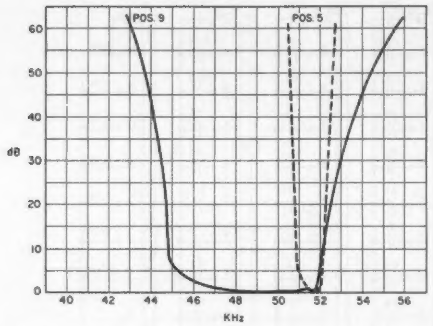


Fig. 4. Measured filter response in switch positions 5 and 9. Response continues beyond −60 dB, but this could not be measured with the simple test equipment at PA0SE.

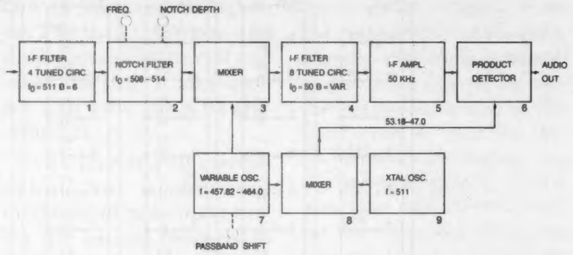


Fig. 5. Block diagram of second and third i-f sections in PA0SE's receiver, incorporating passband shift. Frequencies in kHz.

The attenuation extends beyond 60 dB but I was unable to measure deeper down with the unsophisticated test equipment in my home lab. You can see in Fig. 3 that the "cold end" of circuit 1 is not grounded but connected to +215 V. It is decoupled by a 68-nF capacitor. This was done because the filter is fed from a pentode tube and it receives its anode voltage via the first circuit.

Finding Q_0

The unloaded quality factor, Q_0, of the parallel tuned circuits is also measured using the setup in Fig. 2. C_1L is the circuit under test. First find frequency f_0 of maximum response. Now detune the generator slowly to the frequencies at which the voltage is −3 dB (0.707 times) with respect to the maximum voltage. The frequency difference between those two points is designated b.

We now find Q_0 from $Q_0 = f_0/b$. A frequency counter is almost a must since the frequency differences we deal with are very small. The coils I used have a Q of about 370, as mentioned earlier. That means that at 50 kHz the frequency difference between the −3-dB points is 50,000/370 = 135 Hz.

We do not want to load the circuit by the internal resistances of generator and indicator. This is done by keeping C_2 and C_3 small. To make sure the extra loading by generator and indicator does not influence our result, we can repeat the measurement using the next bigger or smaller value for C_2 and C_3. If the value of Q_0 is the same in this case, we know we have a good result.

Passband Shift

The receiver in which the filter is used also features passband shift, or passband tuning as it was called earlier. This means that the passband can be shifted up or down over the signal without affecting the tuning of the receiver. In conjunction with the passband width selection, this offers unique possibilities for getting rid of QRM. With one hand we move the bandwidth switch to progressively smaller passbands and with the other we adjust the passband shift to put the passband in the optimum position over the received signal.

In my receiver I even have an adjustable notch filter in the 511-kHz i-f preceding the final 50-kHz i-f. This was put in when I had the fixed 2.7-kHz filter at the final i-f. The notch could be used to remove an interfering heterodyne on the wanted signal. Since I replaced the 2.7-kHz filter with the one described here, there is no need to touch the notch filter any more.

How the passband shift is effected will not be described here in detail. Only the principle will be shown, with the help of the block diagram, Fig. 5.

The receiver has a first tunable i-f of 3.5 to 4.5 MHz. The second i-f is 511 kHz. Selectivity on this frequency is provided by a bandpass filter with four tuned circuits. Bandwidth is about 6 kHz. This filter is indicated as 1 in Fig. 5. It is followed by a notch filter (2) with adjustable rejection frequency and notch depth. (As mentioned, this is more or less superfluous with the variable i-f filter now used.) The second i-f at 511 kHz is converted to 50 kHz in the mixer (3). This frequency is the difference between the 511-kHz signal and the oscillator signal from the variable-frequency oscillator (7). This oscillator affects the passband shift, and its frequency can be varied between 457.82 and 464.0 kHz.

This means that a signal at the center of the second i-f at 511 kHz can be shifted between 511−457.82 = 53.18 kHz and 511−464.0 = 47.0 kHz. That is to say, the spectrum of input signals offered to the third i-f filter at 50 kHz can be shifted upwards and downwards.

The output signal from the switchable bandpass filter (4) is amplified (5) and presented to the product detector for conversion to audio. In order to keep the tuned frequency the same when shifting the passband, the oscillator signal for 6 (bfo signal) should be shifted the same amount up or down as the shift of the input signal for the filter (4).

This is realized by mixing the signal from oscillator 7 also with that from a crystal oscillator at 511 kHz (9) in the mixer (8). The output signal of 8 is filtered and it has a frequency between 47.0 and 53.18 kHz, just the same as the signal at the filter input that resulted from a 511-kHz signal at the second i-f.

So although it looks as if the passband of the filter is moved back and forth over the signal, in reality the signal is moved up and down at the filter input and the bfo frequency is moved with it.

There are a few things to be watched with this system. One is that the crystal oscillator (9) and mixer (8) have to be well screened because the 511-kHz signal is in the middle of the second i-f and even a small leakage signal means a standing signal in the receiver. It is always zero beat with the bfo frequency signal so it won't be heard, but it deflects the S-meter.

Also, the output signal of the mixer (8) must be well filtered; otherwise birdies will be heard when the passband shift control is operated.

Helpful in this respect also is keeping the signal from the oscillator (7) in the mixer as small as possible. I managed to get rid of birdies completely after I installed a single-section low-pass filter with a cutoff frequency of about 55 kHz between the mixer and the product detector. ■

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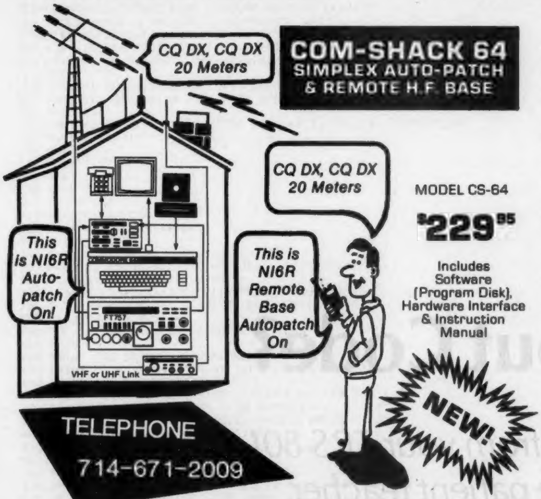

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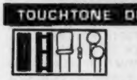

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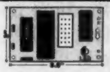

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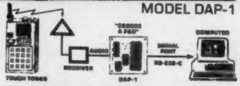

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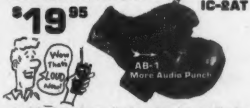

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The program user is presented with several self-explanatory menus. The principal menu gives a choice of six options:

1. Setting the code speed (defaults to 10 words per minute)
2. Setting the audio pitch (defaults to 1000 Hz)
3. Typing arbitrary characters and listening to the corresponding code, which is also displayed as dots and dashes on the monitor screen
4. Listening to a sequence of ten randomly-generated five-character words
5. Listening to the code of randomly-generated characters one by one and then typing a guess (after each guess the program indicates whether the guess was correct and if not, what it should have been; after generating 20 characters the computer gives you a score of how many characters were correctly guessed and what the average delay of your response was)
6. Listening to the code of a previously-stored sentence

Options 4 and 5 allow selection of a subset of characters (e.g., A, B, F, Z, and 7) from which the random choice is made by the program. After listening to the randomly-generated sequence of ten 5-character words (menu option 4), you have the choice of repeating the same sequence, displaying the words on the monitor, or generating a new sequence.

The Basic program shown in Program listing 1 displays the menus and prompts the user. It also sets the time relations between dots, dashes, and pauses between characters and words. The program sets the length of a dash as three times the length of a dot, space between words as seven dot lengths, etc. These and other time relations can be changed by modifying program lines 350–390.

The assembly-language portion of the program shown in Program listing 2 accepts the ASCII value of a character and translates it into a Morse-code sequence of dots and dashes by accessing the code table stored in memory by the Basic section of the program (lines 1140–1260). Two bytes describe each character. The first byte gives the number of dots and dashes—n (if n is larger than 8, then the character will be ignored); the n bits of the second byte from the most to the least significant bit correspond to dots (0s) and dashes (1s). For example, the two bytes de-

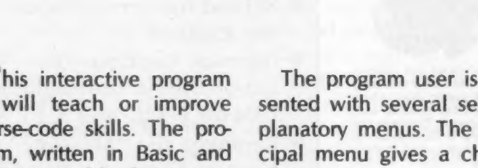

Fig. 1.

```
90 REM COPYRIGHT (C) 1983 CASS R. LEWART
100 REM MORSE CODE PROGRAM VERSION 11/25/83
110 POKE &H40B2,&HF0: POKE &H40B1,&H4E
120 CLEAR1000
130 CLS
140 DIM A$(100),C(100),P(11),M$(64),XC(64)
150 PRINT@455,"MORSE CODE PROGRAM BY C.R. LEWART"
160 PRINT"PROGRAM INITIALIZING, PLEASE WAIT .";
170 D1$="ABCDEFGHIJKLMNOPQRSTUVWXYZ"
180 D2$="1234567890": D3$=";=?,-./"+CHR$(34)+CHR$(58)
190 FOR I=0 TO 125:POKE 2*I-3840,9:NEXT I
200 PRINT".";
210 FOR I=1 TO 64:READ XC(I),Y:POKE 2*I-3778,XC(I)
220 POKE 2*I-3777,Y:M$(I)=" ":IF XC(I)>8 THEN 280
230 X=XC(I)
240 FOR J=1 TO X:Y=2*Y:IF Y<256 THEN M$(I)=M$(I)+".":GOTO 260
250 M$(I)=M$(I)+"-":Y=Y-256
260 NEXT J
270 PRINT".";
280 NEXT I
290 READ G$
300 PRINT".";
310 DEFUSR1=&HF050
320 F1$="###":F2$="#####"
330 S=10: F=1000
340 P(11)=INT(34135/F-10.5)
350 P(1)=0: P(2)=240/S: X1=P(2)*7: P(3)=INT(X1/256)
360 P(4)=X1-P(3)*256: P(9)=0
370 P(10)=P(2)*3:X3=325/P(11)*P(2): P(6)=INT(X3/256)
380 P(5)=X3-P(6)*256: X4=3*X3: P(8)=INT(X4/256)
390 P(7)=X4-P(8)*256
400 FOR I=1 TO 11: POKE I-3857,P(I):NEXT I
410 PRINT
420 PRINT "TO CHANGE TRANSM. SPEED ";
430 PRINT USING F1$;S;:PRINT" WPM";:PRINT TAB(36)"- 1"
440 PRINT "TO CHANGE PITCH";
450 PRINT USING F2$;F;:PRINT" HZ";:PRINT TAB(36)"- 2"
460 PRINT"ENTER CHARACTERS FROM KEYBOARD        - 3"
470 PRINT"OUTPUT FIVE CHARACTER RANDOM WORDS    - 4"
480 PRINT"OUTPUT SINGLE CHARACTERS              - 5 "
490 PRINT"OUTPUT STANDARD SEQUENCE              - 6 ";
500 INPUT G:IF G<1 OR G>6 GOTO500
510 ON G GOTO 520,540,560,660,660,630
520 PRINT: PRINT"ENTER NEW SPEED (WPM >3) ";: INPUT S
530 IF S<3 THEN 520 ELSE GOTO 350
540 PRINT:PRINT"ENTER NEW PITCH (150 < HZ < 2950) ";:INPUT F
550 IF F<=150 OR F >=2950 THEN 540 ELSE GOTO 340
560 PRINT:PRINT"ENTER CHARACTERS ONE BY ONE, TO LEAVE THIS MODE PRESS #: "
570 X$=INKEY$:IF X$=""THEN570
580 IF X$="#"THEN PRINT:GOTO410
590 X1=ASC(X$):IF X1<32 THEN 570
600 IF X1>95 THEN X1=X1-32
610 PRINT X$; M$(X1-31)
620 D=USR1(X1):GOTO570
630 M=LEN(G$):FOR I=1 TO M
640 C(I)=ASC(MID$(G$,I,1))
650 NEXT I: GOSUB 1120:GOTO 1030
660 G1=5:PRINT:PRINT"SELECT A-Z                  - 1"
670 PRINT"SELECT 0-9              - 2"
680 PRINT"SELECT SPEC. CHARACTERS  - 3"
690 PRINT"MAKE YOUR OWN SELECTION  - 4"
700 PRINT"PREVIOUS MENU            ENTER ";
710 INPUT G1
720 IFG1<1 OR G1>5 THEN 710
730 ON G1 GOTO 740,750,760,770,410
740 D$=D1$:GOTO790
750 D$=D2$:GOTO790
760 D$=D3$:GOTO790
770 PRINT:PRINT"ENTER YOUR CHOICE, E.G. ABCDXYZ567 ";
780 INPUT D$
790 L=LEN(D$):IF L<1 OR L>63 THEN PRINT"REPEAT":GOTO 660
800 IF G1<>4 THEN 870
810 FJ=0: FOR J=1 TO L:AS=ASC(MID$(D$,J,1)):IF AS>95 THEN AS=AS-32
820 A$(J)=CHR$(AS)
830 IF XC(AS-31)<=8 THEN 850
840 PRINT"NO CODE AVAILABLE FOR ";A$(J):FJ=1
850 NEXTJ: IF FJ=1 THEN 660
860 IF G1=4 THEN 890
870 IFG=6 THEN 410
880 FOR J=1 TO L: A$(J)=MID$(D$,J,1):NEXTJ
890 IF G<>5 THEN 1000
900 PRINT:PRINT"LISTEN, THEN KEY THE CHARACTER":M1=0:M2=0:M3=20
910 PRINT:FOR J=1 TO 300:NEXTJ
920 FOR J=1 TO M3:T$=A$(RND(L)):D=USR1(ASC(T$))
930 B$=INKEY$: M1=M1+1: IFB$=""THEN 930 ELSE PRINT B$;
940 IF B$=T$ THEN PRINT " O.K." ELSE PRINT " WRONG, SHOULD BE ";T$: M2=M2+1
950 NEXT J
960 PRINT:PRINT "OUT OF ";M3;" CHARACTERS ";M2; " WERE WRONG
970 PRINT"SCORE = ";100*(M3-M2)/M3;" %"
980 PRINT"THE AVERAGE RESPONSE TIME IN MS = ";M1/M3*40
990 PRINT"MORE (Y/N)";:INPUT Y$:IF Y$<>"Y" THEN 410 ELSE 900
1000 M=0:FOR I=1 TO 10: FOR J=1 TO 5:M=M+1
1010 C(M)=ASC(A$(RND(L))):NEXTJ
1020 M=M+1:C(M)=32:NEXT I:GOSUB1120
1030 G2=4:PRINT:PRINT"REPEAT SAME SEQUENCE   - 1"
1040       PRINT"DISPLAY ON MONITOR    - 2"
1050 IFG<>6 PRINT"NEW SEQUENCE            - 3"
1060       PRINT"PREVIOUS MENU      ENTER ";
1070 INPUT G2:IF G2<1 OR G2>4 THEN 1070
1080 ON G2 GOTO 1090,1100,870,660
1090 GOSUB 1120: GOTO1030
1100 PRINT:FOR I=1 TO M: PRINT CHR$(C(I));:NEXT I
1110 PRINT: GOTO 1030
1120 FOR I=1 TO M:D=USR1(C(I))
1130 NEXT I: RETURN
1140 DATA   9,  0,  9,  0,  6, 72,  9,  0,  9,  0
1150 DATA   9,  0,  9,  0,  9,  0,  9,  0,  9,  0
1160 DATA   9,  0,  9,  0,  6,204,  6,132,  6,120
1170 DATA   5,144,  5,248,  5,120,  5, 56,  5, 24
1180 DATA   5,  8,  5,  0,  5,128,  5,192,  5,224
1190 DATA   5,240,  6,224,  6,168,  9,  0,  5,136
1200 DATA   9,  0,  6, 48,  9,  0,  2, 64,  4,128
1210 DATA   4,160,  3,128,  1,  0,  4, 32,  3,192
1220 DATA   4,  0,  2,  0,  4,112,  3,160,  4, 64
1230 DATA   2,192,  2,128,  3,224,  4, 96,  4,208
1240 DATA   3, 64,  3,  0,  1,128,  3, 32,  4, 16
1250 DATA   3, 96,  4,144,  4,176,  4,192,  9,  0
1260 DATA   9,  0,  9,  0,  9,  0,  9,  0
1270 DATA "PROGRAM TO LEARN MORSE CODE BY C R LEWART"
```

Program listing 1.

```
00100 ;MORSE CODE BY C.R. LEWART 03/02/83
00110 GETARG  EQU     0A7FH
00120 PORT    EQU     0FFH
00130 SPC     EQU     020H
00140 TABLE   EQU     0F100H  ;CODE TABLE
00150 MEMSS   EQU     0F0F0H  ;SPACE DASH/DOT
00160 MEMSL   EQU     0F0F2H  ;SPACE BETWEEN WORDS
00170 MEMDOT  EQU     0F0F4H  ;DOT LENGTH
00180 MEMDSH  EQU     0F0F6H  ;DASH LENGTH
00190 MEMEND  EQU     0F0F8H  ;DELAY AFTER CHARACTER
00200 MEMFR   EQU     0F0FAH  ;PITCH/FREQ. DELAY
00210         ORG     0F050H
00220 MORSE   DI
00230         CALL    GETARG  ;GET ASCII VALUE FROM BASIC
00240         LD      A,L
00250         CP      SPC
00260         JR      NZ,OUT1
00270         LD      BC,(MEMSL)
00280         JR      SPACE   ;PUT OUT SPACE
00290 OUT1    PUSH    HL
00300         POP     DE
00310         SLA     E
00320         LD      HL,TABLE
00330         ADD     HL,DE
00340         LD      D,(HL)  ;LOOK UP CODE TABLE
00350         LD      A,8
00360         CP      D
00370         RET     M
00380         INC     HL
00390         LD      E,(HL)
00400 LOOP1   SLA     E
00410         JR      C,DASH1
00420         CALL    DOT
00430         JR      SPACE1
00440 DASH1   CALL    DASH
00450 SPACE1  LD      BC,(MEMSS);SPACE AFTER DASH/DOT
00460         CALL    SPACE
00470         DEC     D
00480         LD      A,D
00490         OR      A
00500         JR      NZ,LOOP1
00510         LD      BC,(MEMEND);PUT OUT FINAL SPACE
00520 SPACE   DEC     BC
00530         LD      A,B
00540         OR      C
00550         JR      NZ,SPACE
00560         RET
00570 DOT     LD      HL,(MEMDOT)
00580         JR      OUT
00590 DASH    LD      HL,(MEMDSH)
00600 OUT     LD      C,01
00610 LOOP2   LD      A,C
00620         CP      01
00630         JR      Z,OUTSIG
00640         CP      02
00650         JR      Z,OUTCEN
00660         CP      04
00670         JR      Z,OUTCEN
00680         CP      03
00690         JR      Z,OUTLOW
00700         JR      OUT
00710 OUTCEN  LD      A,00
00720         JR      OUTSIG
00730 OUTLOW  LD      A,02
00740 OUTSIG  OUT     (PORT),A;CASSETTE OUTPUT
00750         INC     C
00760         PUSH    HL
00770         LD      HL,(MEMFR)
00780         LD      B,L
00790         POP     HL
00800 DEL     DJNZ    DEL         ;FREQUENCY DELAY
00810         DEC     HL
00820         LD      A,L
00830         OR      H
00840         JR      NZ,LOOP2
00850         RET                 ;BACK TO BASIC
00860         END     MORSE
```

Program listing 2.

scribing the code for the letter Y (- . – –) would be 04 and B0 (hex) = 10110000 (binary). The four least significant bits do not matter in this case and can be set to 0s or 1s because Y contains only three dashes and one dot for a total of four symbols. The dots and dashes are "peeled" off by left shifting the second byte and checking the carry register after each shift.

The program as listed here will run on the Radio Shack Model I or Model III computer (also Model 4 in Model III mode) with one disk drive and 48K of RAM. The machine-language part of the program should be assembled and loaded into memory, where it will be accessed by the Basic program. Both parts of the program can easily be modified to other configurations (cassette, 16K RAM, etc.).

For information about availability of derived programs on disk or cassette for such configurations, and also for 6502-based computers (e.g., KIM-1), send an SASE to the author. A ready-to-run, single-density disk with the machine-language program stored as DATA statements for Model I, 48K, is available from C & R Electronics, PO Box 217, Holmdel NJ 07733, for $10.95 ppd. (New Jersey residents add 6% sales tax.) You can convert the disk to the TRS-80 Model III or Model 4 double-density format by means of the Radio Shack CONVERT utility. ■

Scott M. Hower K7KQ
506 Sugarland Run Drive
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Adding 10-MHz capability to your Yaesu FT-101Z is a simple step-by-step process. In just a few hours, you can join the fun on our newest amateur band.

The Yaesu FT-101Z/ZD can be modified to add coverage of the 30-meter band, allowing operation in the newly-authorized amateur segment as well as reception of WWV at 10.0 MHz. Frequency coverage following this modification ranges from 10.0 to 10.5 MHz.

When I started looking into modifying this rig, it appeared at first that adding 30 meters would not be an easy task. As most of the bandswitch lugs in the JJY/WWV position are not provided in the transmitter PA section, it is not possible simply to convert WWV operation to 10 MHz and enable the transmitter. Additionally, local oscillator and mixer components are not provided for the AUX position, although all switch lugs are in place. Therefore, a combination of WWV and AUX was used for this modification.

The WWV section was modified to receive 10.0 to 10.5 MHz rather than 5.0 to 5.5 MHz as is normally the case. Next, the bandswitch lugs for WWV and AUX were jumpered to duplicate receive operation in both bandswitch positions. Finally, the transmitter section was enabled in the AUX switch position. The result was reception of the first 500 kHz of the 10-MHz band in both WWV and AUX switch positions, with transmit operation possible only in the AUX position. This technique prohibits the addition of any future bands, unfortunately, as all switch positions are taken; however, it was the only way to add a new band to the FT-101Z/ZD.

In the FT-101Z/ZD, the 5.0-to-5.5-MHz vfo signal is mixed with a signal generated on the premix local board from a crystal oscillator. By replacing the crystal with a 24.4875-MHz crystal, the output of the mixer after modification will range from 18.9875 to 19.4875. This output signal will then be passed through a bandpass filter on the premix board to allow selection of the difference frequencies only. Following the bandpass filter, this signal is mixed with the incoming rf to produce an i-f frequency of 8.9875 MHz. This modification consists of changing the local oscillator frequency to 24.4875 MHz by replacing a crystal and a capacitor in the oscillator circuit.

Photo A. The FT-101Z.

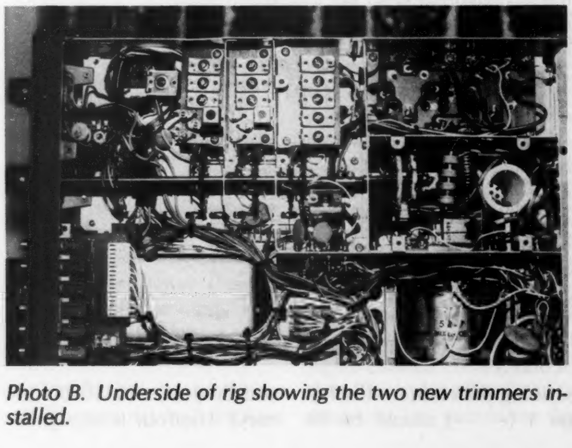

Photo B. Underside of rig showing the two new trimmers installed.

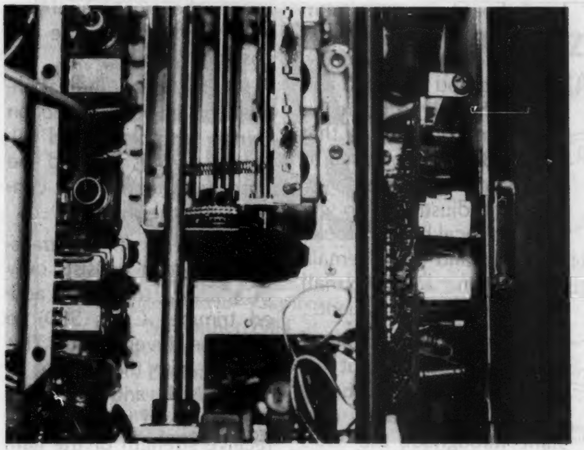

Photo C. The local board on the right and the premix board on the left, near the front of the FT-101Z.

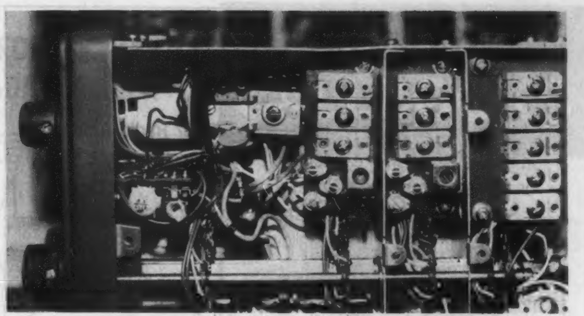

Photo D. The new trimmer capacitor may be soldered directly to the trimmer unit A circuit board.

Next, the bandpass filter frequency is shifted up to approximately 19 MHz by changing a capacitor. Additionally, trimmer capacitors must be added to the rf-input section of the receiver and the driver section of the transmitter; this is necessary because the 40-meter trimmer was simply borrowed for WWV operation in the receiver section before modification, and no trimmer was provided for the driver section. Finally, changes must be made to the final amplifier stage to allow the tank circuit to resonate at 10.0 to 10.5 MHz.

To modify the FT-101Z/ZD, proceed as follows:

1) Remove the top cover and locate the local board (PB-1965). This board is mounted vertically on the right side near the front (Photo C). Remove the board and replace X10 with the new crystal and C40 with a 160-pF silver mica capacitor. Jumper pins 12 and 13 of the edge connector, being careful to keep all solder and jumper wire away from the pins so as not to restrict plugging the board back into its socket. Replace the local board.

2) Locate the premix board (PB-1962), mounted vertically to the left of the local board. Remove the premix board and replace C27 with a 100-pF silver mica capacitor. Preset transformers T13 and T14 by first backing their slugs out all the way in a counterclockwise direction and then turning them one turn in a clockwise direction. Replace the premix board.

3) Turn the rig over and remove the bottom cover. Carefully remove the shields covering trimmer units B and C and the final amplifier compartment. Note that the bandswitch runs from S1A to S1E and S2A to S2D, with S1A closest to the front of the rig. On section S1B, first remove any jumper that may be connected between lug 11 (AUX) and the wiper arm, and then remove the jumper between lug 3 (40 meter) and lug 10 (WWV). Now add a jumper between lugs 10 and 11. Add an 80-pF trimmer in parallel with a 300-pF silver mica between lug 10 and the common side of trimmer A unit. The trimmer can be mounted by soldering its lug directly to the underside of the circuit board (Photo D).

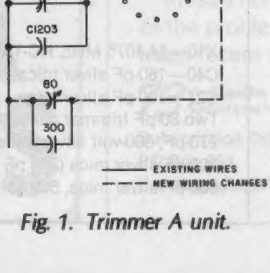

Fig. 1. Trimmer A unit.

4) On S1C, remove any jumper that may be connected to lug 11 and tie lugs 3 (40 meter) and 11 (AUX) together (Fig. 2). The trimmer B unit will have to be removed temporarily to get at the switch lugs. Simply remove the screws that hold the circuit board in place and carefully move trimmer unit B out of the way; there is no need to disconnect any wires.

5) On S1D, remove any jumper that may be connected to lug 11. Then add an 80-pF trimmer in parallel with a 270-pF silver mica between lug 11 (AUX) and the common side of trimmer unit C. The common side can be traced to an unused lug on S1E. The trimmer may be mounted by soldering directly to this unused lug (Fig. 3).

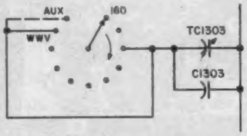

Fig. 2. S1C.

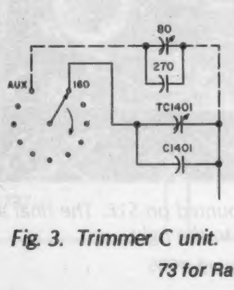

Fig. 3. Trimmer C unit.

6) S2A through D are located in the final compartment. Sections A and B are on opposite sides of the switch wafer located nearest the front, while sections C and D are on the last wafer, closest to the rear. Add a 560-pF capacitor between the AUX lug on S2A and ground. (See Figs. 4 and 5.)

7) On L1, the plate PA coil, connect a new tap 3 turns from the 40-meter tap (towards the 20-meter tap). Connect this tap to the AUX lug of S2D with #18 wire or larger. The connection to L1 can be made by carefully pushing in the turns adjacent to the desired tap point and then soldering to that point; a much easier alternative is to parallel the 40-

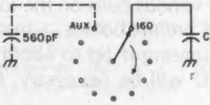

Fig. 4. S2A.

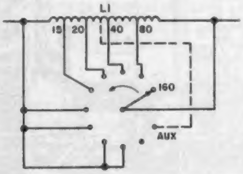

Fig. 5. S2D.

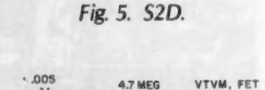

Fig. 6. A simple rf probe.

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meter tap, but this results in the plate and loading controls operating near the limit of their ranges.

This completes the modification of the rig with the exception of alignment at the new frequency. To peak the various coils on the local and premix boards, a means of sensing rf up to about 25 MHz will be necessary. If a wideband oscilloscope is not available, an rf probe can easily be constructed for use with either an inexpensive scope or high-impedance meter such as a VTVM or FET voltmeter (Fig. 6).

To align the rig following modification, place the bandswitch in the AUX position and adjust T10 on the local board for maximum output at pin 1 on that board. Now tune the vfo to 10.1 MHz and peak T13 and T14 on the premix board for maximum output from that board; J301 may be used as an output port. This is a very difficult adjustment to get at as the local board is located close and must remain plugged in. Use a small screwdriver and be patient!

Following adjustment of T13 and T14, the output level from the premix board should remain fairly constant throughout the vfo's range as this is a bandpass filter. I found this adjustment to be not very critical, however, with merely peaking T13 and T14 being sufficient. If the receiver's calibrator marker signal can be heard at 10.1, the S-meter may be used to make this adjustment (the preselect control should peak somewhere in the 10-meter range).

Once T13 and T14 have been adjusted, you should be able to hear the receiver's marker at 10.1 MHz although the preselect control probably will have a broad peak or two peaks. You need to tune the preselector to that peak which increases when you adjust newly-added trimmer A (connected to S1B). If the signal goes down when you adjust the new trimmer, you have the preselect control tuned to the wrong peak. Maximize the signal by adjusting the vfo, the preselector, and the new trimmer A. One distinct peak should be observed now when adjusting the preselect control. To observe the best peak on the S-meter and to aid in fine adjustments, the front panel agc switch should be in the fast position.

Modification and alignment of the receive section is now complete, and 30-meter signals should be heard with an antenna connected to the rig.

Alignment of the transmitter section consists only of adjusting the newly added trimmer C (at S1D) to peak the driver output. This is done with the vfo set to 10.125 MHz and the preselector peaked for maximum receive strength of the calibrator signal. Without adjusting the preselect control further, peak the new trimmer C for maximum drive by observing rf output or PA current. Use as little drive as possible, keeping PA current below 100 mA, and resonate the plate and loading controls as soon as output is obtainable. Be careful not to maintain a key-down condition for long periods of time. Increase the drive level to full output, recheck plate and loading, and peak new trimmer C a final time. This completes alignment of the transmitter section.

No modification is required to make the digital counter in the FT-101ZD operate correctly, as it simply reads the new frequency at the output of the bandpass filter and converts this to 10.0 MHz. Sensitivity and power output are comparable to the other bands, and no problems were encountered during tune-up or normal operation. The preselect control should peak somewhere in the 10-meter band area, while the plate and loading controls should be near mid-range. ■

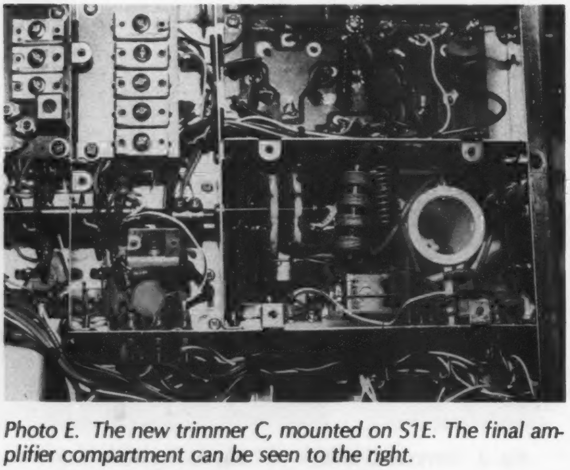

Photo E. The new trimmer C, mounted on S1E. The final amplifier compartment can be seen to the right.

Parts List

X10—24.4875 MHz, HC-18/U package
C40—160-pF silver mica
C27—100-pF silver mica
Two 80-pF trimmer capacitors (Arco 462 or equivalent)
270-pF, 500-volt silver mica
300-pF silver mica (270 pF in parallel with 36 pF may be used)
560-pF silver mica, 500 volt

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For more information about the HD-1422, get Heathkit's new catalog by writing *Heath Company, Dept. 150-592, Benton Harbor MI 49022.* In Canada, write *Heath Company, 1020 Islington Avenue, Dept. 3100, Toronto, Ontario M8Z3.*

MIDLAND LMR 16-CHANNEL HT

A new 16-channel programmable frequency-synthesized portable two-way FM radio has been introduced by Midland Land Mobile Radio. The radio features a front-panel keypad and a liquid-crystal display. VHF models cover 136–174 MHz, and UHF models cover 406–520 MHz; both VHF and UHF models have a switchable output of 5 Watts and 1 Watt.

Tone-coded squelch is a standard feature, and each channel may be separately programmed for any EIA tone. A DTMF option is also available which temporarily stores data entered from the keypad and automatically transmits it when the push-to-talk switch is activated. Other options include an external speaker/microphone with an antenna jack, a programmable scanner, and 600-mAh or 1000-mAh nickel-cadmium battery packs.

For complete details, contact *Midland LMR, Marketing Department, 1690 N. Topping, Kansas City MO 64120.*

Midland LMR's 16-channel FM portable radio.

KENWOOD TM-2570A, TM-2550A, AND TM-2530A

Trio-Kenwood Communications has announced three new 2m FM radios. The TM-25 series offers a choice of three power levels: 70 Watts with the TM-2570A, 45 Watts with the TM-2550A, and 25 Watts with the TM-2530A. The TM-2570A includes a built-in cooling fan.

All three models feature a back-lit 16-key DTMF pad, twenty-three memory channels which store frequency, offset, and subaudible access tone, and an automatic dialer which stores up to fifteen seven-digit telephone numbers.

The TM-25-series radios cover 142–149 MHz and are modifiable to cover 141–151 MHz. Available options include a 38-tone CTCSS encoder, a Digital Channel Link modem, a voice synthesizer, and a call-sign display.

Complete information is available from *Trio-Kenwood Communications, PO Box 7065, Compton CA 90224; (213)-639-9000.*

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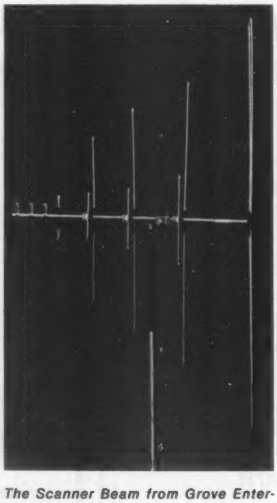
Grove Enterprises has introduced a new antenna for scanner enthusiasts. The Scanner Beam covers 30–960 MHz and includes a balun transformer, an offset pipe, and all necessary mounting hardware.

For additional information, contact *Grove Enterprises, PO Box 98, Brasstown NC 28902; (800)-438-8155.*



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Kenwood's 70-Watt TM-2570A.

VOCOM POWER AMPS

VoCom Products Corporation has introduced a new line of rack-mounted rf power amplifiers for continuous-duty applications such as repeaters or paging systems. Included in the line are models which run directly from 110/220-V-ac mains. Available output powers are 50, 100, and 200 Watts for both VHF and UHF frequencies. Ac-powered models may be configured for battery backup or automatic bypass in the event of a commercial power failure.

For further information, contact *VoCom Products Corporation, 65 East Palatine Road, Prospect Heights IL 60070; (800)-USA-MADE.*

ELECTRONIC SPECIALISTS COMPUTER PROTECTION

Electronic Specialists has introduced the Modem/Power/Static Pac, a protection device for portable computers. The unit combines a broadband ac power filter, a power spike suppressor, a modem spike suppressor and rf filter, and a static discharge plate. Filtered ac is available from both a standard 3-prong outlet and a CEE-22 universal computer power connector. Modem attachment is through modular RJ-11 connectors.

For more information, contact *Electronic Specialists, Inc., 171 South Main Street, Natick MA 01760; (800)-225-4876.*

HAMTRONICS® GaAsFET PREAMPS

Hamtronics, Inc., has announced a low-cost miniature receiver preamplifier for the VHF and UHF bands. The LNW series of preamps uses a dual-gate GaAsFET for a typical gain of 18 dB and a noise figure of 0.8 dB.

A 40-page catalog describing the LNW preamplifier line and other Hamtronics products is available from *Hamtronics, Inc., 65-F Moul Road, Hilton NY 14468-9535; (716)-392-9430.*

PACCOMM TNC-200

PacComm Packet Radio Systems' TNC-200 is a licensed copy of the Tucson Amateur Packet Radio (TAPR) TNC-2 terminal node controller. Available as both an assembled unit and a kit, the TNC-200 features multiple connections, a choice of NMOS or CMOS chips, and full AX.25 version 1 and 2 compatibility.

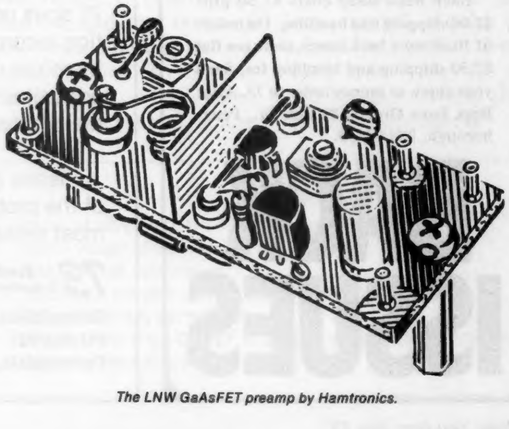
PacComm also has put together partial kits for the TNC-200 which come with hard-to-find parts, a PC board, and an assembly manual. Cabinets and end plates are offered separately.

For further details, please contact *PacComm Packet Radio Systems, Inc., 4040 West Kennedy Blvd., Suite 620, Tampa FL 33609; (813)-689-3523.*

KALGLO PLUG-IN SURGE SUPPRESSOR

Kalglo Electronics' Mini-II is a compact surge suppressor that responds in 5 nanoseconds, suppresses 13,500 pulse-Amps, and has a capacity of 135 Joules. Clamping starts at 150 volts, and its filtering circuit removes 41 dB of noise at 10 MHz in common mode and 49 dB of noise in normal mode. Once plugged into a wall outlet, the unused receptacle receives the same protection as the two outlets on the Mini-II, giving three protected sockets.

For more information, write *Kalglo Elec-*



The LNW GaAsFET preamp by Hamtronics.

tronics Company, Inc., 6584 Ruch Road, Bethlehem PA 18017-9359; (215)-837-0700.

DI-16 REMOTE DATA INTERROGATOR

The DI-16 Data Interrogator from Communications Specialists is designed for remote retrieval of accumulated time and hit information from the TP-38 Shared Repeater Tone Panel. It also may be used to remotely access the TP-38 to enable or disable repeater subscribers. Hard-copy printout is available with a Radio Shack TP-10 serial printer, or the DI-16 may be connected to a host computer for information processing and air-time billing.

The DI-16 uses a sixteen-digit keyboard and has a high-visibility LED display. An automatic PTT keying circuit and an output port for serial communications are standard equipment.

For detailed information about the DI-16 Interrogator, contact *Communications Specialists, Inc., 426 West Taft Avenue, Orange CA 92665-4296; (800)-854-0547.*

POWER LINE PROTECTOR
WARNING
PROTECTED OUTLETS

The Mini-II surge suppressor from Kalglo Electronics.

Model DI-16
Data Interrogator
Power
Transmit
Hours
Frequency

Communications Specialists' DI-16 Data Interrogator.

FUN!

John Edwards KI2U
PO Box 73
Middle Village NY 11379

HOW HAMS VIEW THEMSELVES

Six years of "Fun!" polls. That's a long stretch of time, to say the least.

I remember well the day I put together the first poll. I had just finished putting a new coil in my spark transmitter when my friend Horace pulled up the driveway in his 1912 Model T.

"Hi, John!" said Horace, as he folded down the rumble seat. "How's the mobile antenna project coming along?"

"Not bad," I replied. "But you wouldn't believe how many windings have to go into a 300-meter loading coil. . .real bear to wind."

"Think it'll work?" he asked.

"In theory it should. But whenever I attach the antenna to my Locomobile's rear bumper, it lifts the car's front wheels off the ground," I grumbled.

"Tough luck, OM," said Horace, as he played with my new mobile rig's coupler.

Okay, okay, I'm exaggerating, but it *has* been a long time.

This year, as in previous "Fun!" polls, we're retaining many old questions to track developing trends in our hobby and adding some new ones to keep up with the times. Whatever your views, send your responses to PO Box 73, Middle Village NY 11379. Or, if you've given up on the US Mule, you can transmit your answers electronically. My CompuServe ID is 70007,412 (CIS) or 76004,174 (EIS). My Source ID, if you prefer that system, is CPA117. You may also contact me via MCI Mail; just type my name at the "To:" prompt.

ELEMENT 1 BACKGROUND

1) Sex:
A) Male
B) Female

2) Age:
A) 15 or below
B) 16–21
C) 22–39
D) 40–59
E) 60 years and up

3) License class:
A) Novice
B) Technician
C) General
D) Advanced
E) Extra

4) Number of years licensed:
A) 1 year or less
B) 1–5 years
C) 6–10 years
D) 11–20 years
E) 21 years and up

5) Do you have a new (post-March '78) call?
A) Yes
B) No

6) How many hours a week do you devote to amateur radio?
A) 0–1 hour
B) 2–5 hours
C) 6–10 hours
D) 11–20 hours
E) 21 hours or more

7) Which HF band do you use most?
A) 80/75 meters
B) 40 meters
C) 20 meters
D) 15 and/or 10 meters
E) Don't operate HF

8) Which VHF/UHF band do you use most?
A) 6 meters
B) 2 meters
C) 220 MHz
D) 420 MHz and/or up
E) Don't operate VHF/UHF

9) Which mode do you use most?
A) SSB
B) CW
C) FM
D) RTTY
E) Other

10) How much money have you spent on amateur radio within the past year? (Include QSL expenses, magazine subscriptions, club dues, and other incidental expenses.)
A) 0–$250
B) $251–$500
C) $501–$1,000
D) $1,001–$2,500
E) $2,501 and up

ELEMENT 2 SOCIAL CHARACTERISTICS

11) On the whole hams are:
A) too young
B) too old
C) just the right age

12) Do you like rock music?
A) Yes
B) No

13) Politically, how would you define yourself?
A) Conservative
B) Middle-of-the-road
C) Liberal

RESPONSE FORM

Instructions: Read each question and mark your response by circling the appropriate letter next to the number of the question.

Element 1:
1) A B
2) A B C D E
3) A B C D E
4) A B C D E
5) A B
6) A B C D E
7) A B C D E
8) A B C D E
9) A B C D E
10) A B C D E

Element 2:
11) A B C
12) A B
13) A B C
14) A B
15) A B C D E
16) A B
17) A B
18) A B C D E
19) A B
20) A B
21) A B
22) A B
23) A B
24) A B

Element 3:
25) A B
26) A B
27) A B
28) A B
29) A B
30) A B
31) A B
32) A B
33) A B C D E
34) A B C D E
35) A B
36) A B
37) A B
38) A B
39) A B C D E
40) A B
41) A B
42) A B
43) A B
44) A B
45) A B C D E
46) A B C D E
47) A B C D E
48) A B C D E
49) A B
50) A B

Comments: ____

14) Should we get rid of the ARRL?
A) Yes
B) No
15) How old were you when you first became a ham?
A) 15 or below
B) 16–21
C) 22–39
D) 40–59
E) 60 or above
16) Should the FCC increase the speeds on amateur CW examinations?
A) Yes
B) No
17) Do you own a home computer?
A) Yes
B) No
18) If you answered "yes" to question 17, which brand?
A) Apple
B) IBM
C) Radio Shack
D) Commodore
E) Other
19) Do you think that home computing is siphoning people (including youngsters) away from amateur radio?
A) Yes
B) No
20) Are hams getting dumber?
A) Yes
B) No
21) Do business interests deserve some of our virtually abandoned bands?
A) Yes
B) No
22) Should ham licenses have a minimum age requirement?
A) Yes
B) No
23) Should ham licenses have a maximum age requirement?
A) Yes
B) No
24) Should hams be subject to periodic retesting?
A) Yes
B) No

ELEMENT 3
OPERATING HABITS

25) If the users were restricted to data communication only (no phone or CW operation), would you be in favor of a no-code 220-MHz Digital-class license?
A) Yes
B) No
26) Would you be in favor of a no-code 220-MHz Digital-class ticket if it permitted phone operation in addition to data transmission?
A) Yes
B) No
27) Have you ever used a personal computer in connection with your amateur-radio activities?
A) Yes
B) No
28) Is it time to completely deregulate amateur radio by having the FCC turn over all responsibility for ham operation to the amateur community?
A) Yes
B) No
29) What do you think of people who view pay-television services with MDS converters and satellite dishes that are not approved by broadcasters?
A) They're skunks.
B) They're within their rights.
30) Should we get rid of, or reduce in size, the CW subbands?
A) Yes
B) No
31) Do you think DX nets have a place in ham radio?
A) Yes
B) No
32) Do you think nets in general have a place in ham radio?
A) Yes
B) No
33) The next time a ham operates from space, which band should he/she use?
A) 2 meters
B) 220 MHz
C) 450 MHz
D) An even higher band
E) Shouldn't bother to operate
34) If, while tuning across a band, you heard a net called "Jammers International" in progress, would you:
A) Jam it
B) Ignore it
C) Complain to the FCC or some other organization
D) Listen
E) Join it
35) If required, could you solidly copy CW at the speed at which you were licensed?
A) Yes
B) No
36) If required, could you pass the FCC theory test for your license class?
A) Yes
B) No
37) Have you ever purposely operated in an amateur subband you weren't licensed to use?
A) Yes
B) No
38) Are you fluent in any computer language?
A) Yes
B) No
39) If you answered "yes" to question 38, which language?
A) Basic
B) Pascal
C) Assembler
D) Machine
E) Other
40) Do you feel yourself competent to write a short Basic program?
A) Yes
B) No
41) Do you feel yourself competent to replace the finals in a transistor-type rig?
A) Yes
B) No
42) Do you solder together your own coax connectors?
A) Yes
B) No
43) Do you own a TVRO (home earth satellite) system?
A) Yes
B) No
44) Do you operate a packet-radio system?
A) Yes
B) No
45) What do you think of contesting?
A) Great
B) Good
C) Okay
D) Don't like it
E) Despise it
46) What do you think of DXing?
A) Great
B) Good
C) Okay
D) Don't like it
E) Despise it
47) What do you think of repeaters?
A) Great
B) Good
C) Okay
D) Don't like them
E) Despise them
48) What do you think of traffic handling?
A) Great
B) Good
C) Okay
D) Don't like it
E) Despise it
49) If you heard an emergency net in progress, would you immediately join in and offer your services?
A) Yes
B) No
50) Have you ever secretly hoped for a minor disaster to strike your community just so you could demonstrate your radio skills?
A) Yes
B) No

SATELLITES

USING THE AO-10 APOGEE PREDICTIONS

Apogee predictions for the month of February are provided for three sections of the United States: Washington DC at 39N 77W, Kansas at 39N 95W, and California at 38N 122W. Times are in UTC and apogee in this case is mean anomaly 128 rounded to the nearest whole hour. Use the chart as a guide in aiming your antenna, then fine-tune the azimuth and elevation values to peak the satellite's beacon signal. If you require more accurate orbital predictions, contact AMSAT at PO Box 27, Washington DC 20044.

AMSAT-OSCAR 10 APOGEE PREDICTIONS
February 1986

			WASH		KANSAS		CALIF	
ORBIT	DAY	TIME	AZ	EL	AZ	EL	AZ	EL
2313	1	0200					217	7
2315	2	0100					208	12
2317	3	0100			224	1	202	14
2319	4	0000			216	7	192	17
2321	4	2300	222	3	207	11	182	18
2323	5	2300	217	6	201	13	175	17
2325	6	2200	208	11	191	16	165	16
2327	7	2100	198	14	181	17	155	13
2329	8	2000	188	17	170	16	145	9
2331	9	2000	181	16	164	15	140	5
2333	10	1900	171	16	154	12	132	0
2335	11	1900	165	15	148	9		
2337	12	1800	155	12	140	4		
2339	13	1700	145	8				
2341	14	1700	140	4				
2343	15	1600	133	0				
2348	18	0200					229	0
2350	19	0100					221	5
2352	20	0100					216	8
2354	21	0000					207	12
2356	21	2300					197	16
2358	22	2300			215	7	190	17
2360	23	2200	220	4	206	12	180	17
2362	24	2100	212	9	196	15	169	17
2364	25	2100	206	11	189	16	163	15
2366	26	2000	196	14	179	16	153	12
2368	27	1900	186	16	168	15	144	8
2370	28	1900	180	16	162	14	139	4

HAM HELP

I need a station monitor that is compatible with the Heath HW-101. Heath made one, but I can't remember its nomenclature. I will pay UPS charges to Hawaii.

Fred Smallwood WA4JVL
COMTHIRDFLT
Pearl Harbor HI 96860

I'm looking for a nonworking Arnco Marine VHF synthesized radio with a schematic or service manual, and a Hallicrafters 2m unit.

Gary Bernard
1025 Meadowlark
Merritt Island FL 32953

I need a manual for a VHF Engineering Synthesizer II.

Jim Patterson WB5UGZ
25 Schaeffer Lane
Freehold NJ 07728

I'm looking for copies of these military manuals: NAVSHIPS 0967-173-7010 Volume 1, NAVSHIPS 92175, NAVSHIPS 93210, and MIL-R-12887.

Charles T. Huth WB8NLM
229 Melmore Street
Tiffin OH 44883

Has anyone had any experience with a program called "Morse Code in Color" from the December, 1982, issue of *80 Micro*?

Nathan Leichty
946 Knapp
Grand Rapids MI 49505

I'm looking for a schematic for a 1-C single-slot coin telephone. I will pay a reasonable price for the original or a copy.

Mel Wardean K6QXE
18193 Fisher Drive
Visalia CA 93291

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MOBILE IGNITION SHIELDING. Free literature. Estes Engineering, 930 Marine Drive, Port Angeles WA 98362. BNB006

MILITARY TECHNICAL MANUALS for old and obsolete equipment. 60-page catalog, $3.00. Military Technical Manual Service, 2266 Senasac Ave., Long Beach CA 90815. BNB045

HAM RADIO REPAIR, tube through solid state. Robert Hall Electronics, PO Box 8363, San Francisco CA 94128; (408)-729-8200. BNB219

QSLS to order. Variety of styles, colors, card stock. W4BPD QSLs, PO Drawer DX, Cordova SC 29039. BNB260

THE DX'ERS MAGAZINE. Up-to-date, informative, interesting. Compiled and edited by Gus Browning W4BPD, DXCC Honor Roll Certificate 2-4. Send for *free* sample and subscription information today. PO Drawer DX, Cordova SC 29039. BNB261

FIND OUT what else you can hear on your general-coverage transceiver or receiver. Join a shortwave radio listening club. Complete information on major North American clubs and sample newsletter, $1.00. Association of North American Radio Clubs, 1500 Bunbury Drive, Whittier CA 90601. BNB310

INDIVIDUAL PHOTOFACT FOLDERS: #1 to #1400, $3.00 postpaid. AJL, 414 Chestnut Lane, East Meadow NY 11554. BNB312

IMRA—International Mission Radio Association. Forty countries, 800 members. Assists missionaries with equipment loaned, weekday net. 14.280 MHz, 2:00–3:00 pm Eastern. Brother Bernard Frey, 1 Pryer Manor Road, Larchmont NY 10538. BNB326

ELECTRON TUBES: receiving, transmitting, microwave all types available. Large inventory means next-day shipment in most cases. Daily Electronics, PO Box 5029, Compton CA 90224; (213)-774-1255. BNB330

RADIO TRANSCRIPTION DISCS WANTED. Any size, speed. W7FIZ, Box 724—WG, Redmond WA 98073-0724. BNB347

CABLE CONVERTERS. Lowest price. Dealer inquiries accepted. Quantity discounts. Free catalog. P.G. Video Corp., 61 Gatchell St., Dept. 73, Buffalo NY 14212. BNB349

TR-7 USERS—NB-7 noise blanker, new, $65 ppd. SL-300 CW filter, new, $50 ppd. HS-75 headset by Drake, new, $14 ppd. Tony Musero K3UKW, (215)-271-8898. BNB380

CABLE TV CONVERTERS and equipment. Plans and parts. Build or buy. Free information. C & D Electronics, PO Box 1402, Dept. 73, Hope AR 71801. BNB383

QSL CARDS: 100 for $5.00, 500 for $18.00. For a sample, send an SASE to Ken Hand WB2EUF, PO Box 708, East Hampton NY 11937. BNB388

KENWOOD 430S OWNERS! Stop 430S scanner on busy frequencies. When clear, resume automatically! Squelch-activated! Reviewed *QST* 6/85, *73* 2/85, *Worldradio* 12/84. $19.95; $29.95 assembled. $2.50 shipping. JABCO Stop Scan, R1 Box 386, Alexandria IN 46001. BNB396

SSB SQUELCH for any radio! Improved circuitry! Active filters! 2½ " × 5½ ". $54.95 plus $2.50 shipping. JABCO Squelch-It, R1 Box 386, Alexandria IN 46001. BNB397

SOLAR-ELECTRIC MODULES. Dealer price list, $1.00. Homestead Distributing, PO Box 451, Northport WA 99157; (509)-732-6142. BNB398

SURPLUS AND MORE SURPLUS. Thousands of items, free bargain-packed flyers. ETCO Electronics, Plattsburgh NY 12901. BNB399

XEROX MEMORYWRITER—parts, assemblies, boards, manuals. Free help with service problems. W6NTH, Box 250, Benton AR 72015; (501)-776-0920. BNB404

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HAM TRADER YELLOW SHEETS, in our 24th year. Buy, swap, sell ham-radio gear. Published twice a month. Ads quickly circulate—no long wait for results. SASE for sample copy. $10.00 for one year (24 issues). PO Box 2057, Glen Ellyn IL 60138-2057. BNB412

WANTED: ICOM IC-SP2 speaker, AN/URA-17A, support brackets, and plug sets. C. T. Huth, 229 Melmore St., Tiffin OH 44883. BNB413

ANTENNA—1 New Hy-Gain TH5DXX 5-element beam in factory box, $275. 1 Wilson M204 4-element 20-meter beam, used, $150. Money order only. Loyd H. Richey WB4BMQ, Rt. 7, Box 146-A, Boaz AL 35957; (205)-593-5546. BNB414

BE OUR VALENTINE! Your unwanted equipment would be greatly appreciated by the Cupids learning English through amateur radio at Junior High School 22 on Manhattan's Lower East Side. Send it today via WB2JKJ and remember: Not only are we lovable, we're also deductable. BNB415

FOR SALE: Hickock Oscillograph, model 505A, good condition, $100. John N5HHL, 505 West Broadway, Kingfisher OK 73750; (404)-375-6473. BNB416

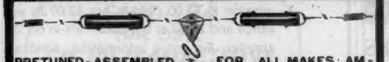
from page 4

the 14th of November, and the Fredericksburg "A" index jumped to a disturbed level of 22 on the 13th. Perhaps not coincidentally, there was a solar eclipse on the 12th and a solar-flux peak on the 15th. Of course there is no claim that the alignments caused the volcanism, but you do see some interesting events. The Mexican earthquake of September followed by one day a jump in the Fredericksburg "A" index to 28, and was shortly followed by a 90-degree alignment of Uranus and Mercury...and, by the way, it was only three days after that Hurricane Gloria began its rampage toward contact with New England.

One should bear in mind that I did not predict any of these natural disasters, but of the days between the 20th and 27th of September, I predicted propagations of Fair or Poor for six of the seven days. In November, on the four days between the 12th and 15th, I predicted Fair for two days and Poor for two days, which just happened to coincide with actual band conditions.

I think that circumstances point to the need for a closer look at these relationships and a concerted effort to attempt to rationalize them for purposes of communications efficiency and—hopefully one day in the future—for helping save lives and property.

Jim Gray



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315

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DOPPLER SYSTEMS, INC. 5540 E. Charter Oak,
Scottsdale, AZ 85254 (602) 998-1151

SPECIAL EVENTS

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received by 73 Magazine by the first of the month, two months prior to the month in which the event takes place. Mail to Editorial Offices, 73 Magazine, Pine St., Peterborough NH 03458.

TN HOMECOMING
FEB 1–2

The amateur-radio clubs of Johnson City, East Tennessee State University, and Carter County, Tennessee, will operate special-event station W4ABR on February 1–2, 1986, to celebrate "Homecoming 86" for the state of Tennessee. Frequencies will be the lower portion of all bands (including Novice) as conditions permit. Send an SASE to W4ABR, PO Box 3682 CRS, Johnson City TN 37602.

BATTLE OF KWAJALEIN AND ROI-NAMUR
FEB 1–10

The Kwajalein Amateur Radio Club will operate special-event station KX6BU from 0600 UTC on February 1, 1986, until 0600 UTC on February 10, 1986, to commemorate the 42nd anniversary of the Battle of Kwajalein and Roi-Namur. Frequencies will be: SSB—28.550, 21.350, and 14.250; CW—28.050, 21.050, 14.050, and 7.025. For $6.00, stations working KX6BU will be issued a certificate, a QSL, and a 64-page book describing the Battle of Kwajalein and Roi-Namur. $3.00 will bring a QSL and a certificate. All requests should be sent to: KX6BU, Box 444, APO San Francisco 96555-008.

PUNXSUTAWNEY PHIL
FEB 2

The Punxsutawney Amateur Radio Club will operate special-event station KA3CUY on Sunday, February 2, 1986, beginning at 9:00 am EST, to commemorate Groundhog Day 1986. Frequencies are 3.950 and 7.230 MHz ±QRM. KA3CUY will carry a recording of the official proclamation for the next 6 weeks' weather (as determined by Punxsutawney Phil). For a certificate, send a QSL and a large SASE to PARC, RD 5, Box 14, Brookville PA 15825.

LORAIN OH
FEB 2

The Northern Ohio ARS will hold its annual Winterfest on Sunday, February 2, 1986, beginning at 8:00 am, at Gargus Hall, Lorain OH. Admission is $2.00 in advance and $2.50 at the door. 8-foot tables are $7.00. Talk-in on 146.10/.70. For tickets or more information, write NOARS Winterfest, PO Box 354, Lorain OH 44052.

INVERNESS FL
FEB 8

The Sky High ARC will sponsor a ham flea market on February 8, 1986, from 9:00 am to 4:00 pm, at the Citrus County Fairgrounds auditorium, on US 41 south of Inverness FL. Admission is $1.50 in advance and $2.50 at the door. License exams will be given. Talk-in on 146.955. For more information, write SHARC Hamfest, PO Box 572, Lecanto FL 32661, or call Bob Gordon W1KUL at (904)-628-5045.

ST. CATHARINES ONT
FEB 8

The Niagara Peninsula ARC will hold its annual hamfest and flea market on Saturday, February 8, 1986, beginning at 8:00 am, at the UAW Hall, Bunting Road, St. Catharines, Ontario. Talk-in on 147.240/.840. For more information, contact NPARC, Box 692, St. Catharines, Ontario LR2 6Y3, Canada.

ORANGE NJ
FEB 9

The West Orange ARC will hold a hamfest on February 9, 1986, from 8:00 am to 4:00 pm, at the Orange Elks Club, 475 Main Street, Orange NJ. Admission is $3.00. Tables are $10.00. Talk-in on 146.55 and 224.80. For more information, call Mike at (201)-736-4611 after 5:00 pm, or call Rob at (201)-731-9506 or (201)-674-8148 any time.

MARLBORO MA
FEB 16

The Algonquin ARC will hold its annual hamfest/electronic flea market on Sunday, February 16, 1986, beginning at 10:00 am, in the Marlboro Junior High School cafeteria. Admission is $1.00. Tables are $7.50 in advance and $10.00 at the door. Seller setup begins at 8:30 am. Talk-in on .01/.61 and .52. For reservations or more information, contact the AARC, PO Box 258, Marlboro MA 01752; (617)-393-9920.

SPOONER WI
FEB 16

The Wild Rivers ARC will hold its midwinter swapfest on Sunday, February 16, 1986, from 10:00 am to 3:00 pm, at the Spooner Experimental Farm, east of Spooner WI on Highway 70. Exams will be given. Tables are available. Talk-in on 147.81/.21. For more information, contact Tom Young KD9FC, Route 5, Box 5239, Hayward WI 54843.

MANSFIELD OH
FEB 16

The Mansfield Midwinter Hamfest/Auction will be held on Sunday, February 16, 1986, beginning at 7:00 am, at the Richland County Fairgrounds, Mansfield OH. Admission is $3.00 in advance and $4.00 at the door. Tables are $5.00 in advance and $6.00 at the door. Talk-in on 146.34/.94 (W8WE). For tickets or more information, contact Dean Wrasse KB8MG, 1094 Beal Road, Mansfield OH 44905; (419)-589-2415 after 3:00 pm EST.

FRIDLEY MN
FEB 22

The Robbinsdale ARC will sponsor the fifth annual Midwinter Madness Hobby Electronics Show on February 22, 1986, from 7:00 am to 2:00 pm, at Totino-Grace High School, 1350 Gardena Avenue NE, Fridley MN. Admission is $3.00 in advance and $4.00 at the door. 8-foot tables are $8.00; 1/2 tables are $4.00. Exams will be given. Talk-in on 147.60/.00 (K0LTC) and .52 simplex. For more information or to register, contact the Robbinsdale ARC, PO Box 22613, Robbinsdale MN 55422, or call Bob at (612)-533-7354.

GLASGOW KY
FEB 22

The Glasgow Swapfest will be held on Saturday, February 22, 1986, beginning at 8:00 am, at the Glasgow Flea Market Building, two miles south of Glasgow KY, just off Highway 31E. Admission is $2.00; no extra charge for exhibitors. The first table is free, and each additional table is $3.00. Talk-in on 146.34/.94. For more information, contact Mike Goad N4HCO, Route 4, Box 354, Glasgow KY 42141.

LA PORTE IN
FEB 23

The LaPorte ARC will sponsor a hamfest on Sunday, February 23, 1986, at the La Porte Civic Auditorium, La Porte IN. Admission is $3.00. Tables are $2.00 in advance and $2.50 at the door. Talk-in on .52 simplex. For more information, send an SASE to LARC, PO Box 30, La Porte IN 46350. For table reservations, mark your correspondence to the attention of KA9PHA.

DAVENPORT IA
FEB 23

The Davenport Radio Amateur Club will hold its 15th annual hamfest at the Davenport Masonic Temple, Brady Street (Highway 61) and 7th Street, Davenport IA, on Sunday, February 23, 1986, from 8:00 am to 4:00 pm. Admission is $2.00 in advance; $3.00 at the door. Tables are available by reservation for $7.00, with $2.00 extra for ac hookup. Table setup begins at 7:00 am. Talk-in on 146.28/.88 (W0BXR). For reservations, advance tickets, or more in-

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formation, contact Dave Johannsen, 2131 Myrtle Street, Davenport IA 52804.

TALLMADGE OH
FEB 23

The Cuyahoga Falls ARC will sponsor its 32nd annual Electronics Equipment Auction and Hamfest on Sunday, February 23, 1986, from 8:00 am to 3:00 pm, at Tallmadge High School, Tallmadge OH. Admission is $3.00 in advance and $4.00 at the door. 8-foot tables are $5.00 in advance (send an SASE). Talk-in on .87/.27. For tickets or more information, contact Bill Sovinsky K8JSL, 2305 24th Street, Cuyahoga Falls OH 44223; (216)-923-3830.

VIENNA VA
FEB 23

The Vienna Wireless Society will hold its annual Winterfest on February 23, 1986, beginning at 8:00 am, at the Vienna Community Center, 120 Cherry Street, Vienna VA. Admission is $4.00 (children 12 and under are free). Tailgating is $7.00 (includes one admission). Talk-in on 146.31/.91 and 147.51. For more information, contact the Vienna Wireless Society, PO Box 418, Vienna VA 22180.

CIRCLEVILLE OH
MAR 2

The Teays ARC will sponsor a hamfest on Sunday, March 2, 1986, from 8:00 am to 4:00 pm, at the K of C Building, 2489 North Court Street, Circleville OH. Tickets are $3.00 in advance and $4.00 at the door. Tables are $5.00 in advance and $6.00 at the door. For tickets (send an SASE) or more information, contact Dan Grant W8UCF, 22150 Smith Hulse Road, Circleville OH 43113; (614)-477-3026.

CHICOPEE MA
MAR 2

The Mount Tom Amateur Repeater Association will hold its annual flea market on March 2, 1986, from 8:00 am to 3:00 pm, at the Knights of Columbus Elder Council 69, Granby Road, Chicopee MA. Admission is $1.00; ladies and children under 12 are free. Tables are $7.00 in advance and $8.00 at the door. For more information, contact MTARA, PO Box 3494, Springfield MA 01101.

WINCHESTER IN
MAR 2

The Randolph Amateur Radio Association will sponsor a hamfest on Sunday, March 2, 1986, from 8:00 am to 5:00 pm, at the Winchester National Guard Armory, Winchester IN. Admission is $3.00 (under 12 free). Spaces are $5.00 with a table and $2.50 without (available by reservation only). Talk-in on 147.90/.30 and 224.90/223.30. For reservations or more information, write RARA, PO Box 162, Winchester IN 47394, or call Jake Life W9VJX at (317)-584-9361 or Herb James WB9UZZ at (317)-584-4995.

DALTON GA
MAR 8

The Dalton ARC will hold its annual hamfest on March 8, 1986, at the North Georgia Fairgrounds, Dalton GA. Further information may be obtained from the local HF and VHF nets or by writing the Dalton ARC, PO Box 143, Dalton GA 30722-0143.

MILWAUKEE WI
MAR 8

The Milwaukee School of Engineering ARC (W9HHX) will sponsor its annual hamfest on Saturday, March 8, 1986, from 8:00 am to 2:00 pm, at 1121 North Milwaukee Street, Milwaukee WI. Tickets are $2.00 and 4-foot tables are $3.00. Talk-in on 146.19/.79 and 146.52. For more information, send an SASE to W9HHX Fest, PO Box 644, Room C-6, Milwaukee WI 53201-0644.

AUBURN NY
MAR 15

The Auburn ARA will hold its annual Winterfest on March 15, 1986, from 9:00 am to 5:00 pm, at the Farm/Home 4H Center, Grant Ave./Route 5, Auburn NY. Admission is $3.00; tables are $5.00. Testing will be available. Talk-in on 147.00. For more information, contact Robert C. Bruno WA2ITJ, 1 Birch Lane, Auburn NY 13021.

GRAYSLAKE IL
MAR 23

The Libertyville and Mundelein ARS will sponsor LAMARSFEST 86 on Sunday March 23, 1986, from 8:00 am to 2:00 pm, at the Lake County Fairgrounds, Grayslake IL. Admission is $2.00 in advance and $3.00 at the door. Tables are $5.00 each. Talk-in on 147.63/.03 and 146.52. For information or reservations, write Marc Abramson, PO Box 633D, Wheeling IL 60090.

CORRECTIONS

An error crept into Gary Sargent's "One-Chip Facsimile" project for the Atari 800 (December, 1985, page 38). Please replace Fig. 1 with the correct version shown here.

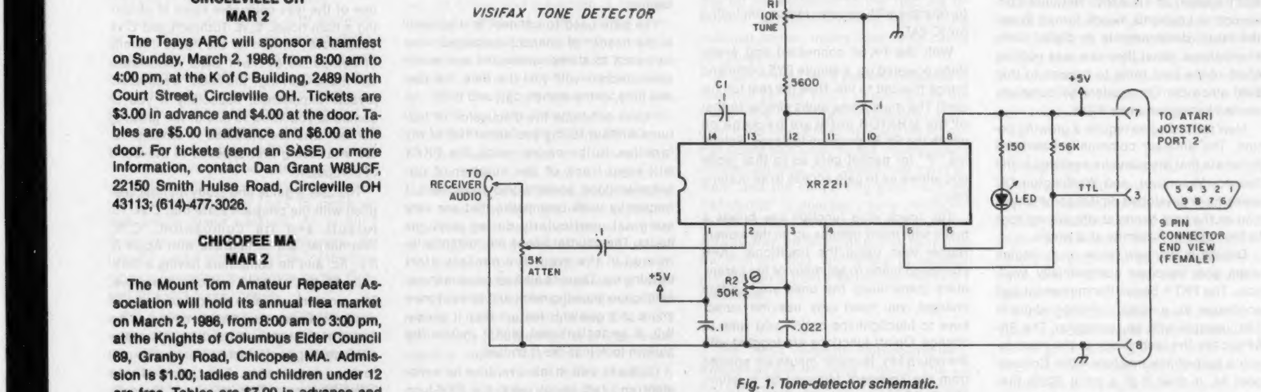
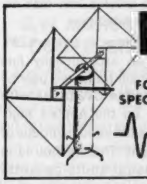


Fig. 1. Tone-detector schematic.



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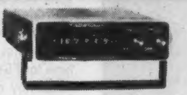

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REVIEW

AEA PK-64 PAKRATT™ DATA CONTROLLER

To borrow a phrase, the packet revolution has become a process of evolution. Mankind as we know it has evolved slowly, but it seems that new digital technologies are being implemented and improved almost overnight. The current trend in low-cost, versatile amateur equipment takes another giant leap forward with AEA's introduction of the PK-64.

At the 1985 Dayton Hamvention, the introduction of several packet-radio TNCs all but stole the show. The TAPR people were there touting the new low-cost TNC-2, Kantronics brought the Packet Communicator, and GLB and Heathkit displayed their wares. AEA stood quietly in the corner with the PKT-1 and showed off Doctor QSO™ to the delight of the convention-goers. Were those all-knowing smiles on the faces of the AEA staff?

With the public showing of AEA's PAKRATT system at the ARRL National Convention in Louisville, heads turned to see the latest developments in digital communications. What they saw was nothing short of the best thing to happen to that field since the Commodore 64 computer started selling for under $200!

New technologies require a growing period. The amateur community has been fortunate that the pioneers centered in the Tucson, Vancouver, and Washington DC areas have developed digital communication on the ham bands at virtually no cost to the amateur fraternity as a whole.

Growth in any new mode really begins when gear becomes commercially available. The PKT-1 began the movement and continues as a solid, commercial-grade TNC useable with any computer. The PK-64 applies the technology to the most favorite ham-shack machine—the Commodore 64. It does it at a price ($220) that should certainly prove to be "popular" with the ham community.

If I started telling you about all of the features of the PK-64, *73* would have to add a special section just to hold this review. The versatility and capabilities of the unit are almost overwhelming.

I can simplify much of this by suggesting that you check the back issues of *73* for my reviews of the CP-1 computer patch and MBATOR software from AEA. You see, PAKRATT not only operates packet like a champion, it gives you CW, RTTY, ASCII, and AMTOR operation all in one package! In my shack, it replaces several software packages and at least two interfaces.

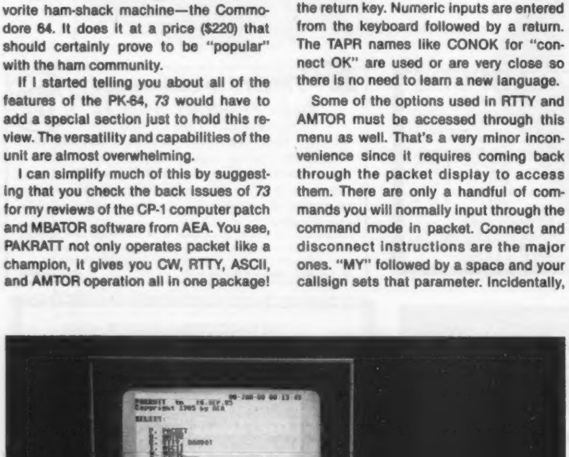
The box containing the PK-64 is styled in the same fashion as the PKT-1 and CP-1. It is small in stature and is deeper than it is wide. The front panel is uncluttered. Depending on whether you have the optional high-frequency modem (HFM-64) installed, the front panel includes a DCD (data carrier detect) and PTT LED. With the HFM-64 installed, a threshold control and a tuning indicator are visible. Otherwise, just a red window and snap-in hole cover round out the front of the unit.

Emerging from the side of the PK-64 is a shielded ribbon cable designed to connect to the C-64 expansion port. That's the same one you use to plug in game and program cartridges. The familiar 5-pin connectors for radio-interfacing, audio-in, and external-speaker jacks are located on the rear panel. An external 13-volt-dc adapter is supplied and plugs into a rear connection. I had no trouble hooking the unit up to operate with several radios, including my IC-2AT.

With the PK-64 connected and everything powered up, a simple SYS command brings the unit to life. Now the real fun begins! The main menu looks similar to that of the MBATOR software package on which the PK-64 program is based. Selecting "P" for packet gets us to that mode and allows us to gain access to an options menu.

The touch of a function key brings a menu with many options up on the screen. Rather than using the traditional TAPR command mode to set many of the parameters (particularly the ones you seldom change), you need only use the cursor keys to highlight the option you wish to change. On/off functions are toggled with the return key. Numeric inputs are entered from the keyboard followed by a return. The TAPR names like CONOK for "connect OK" are used or are very close so there is no need to learn a new language.

Some of the options used in RTTY and AMTOR must be accessed through this menu as well. That's a very minor inconvenience since it requires coming back through the packet display to access them. There are only a handful of commands you will normally input through the command mode in packet. Connect and disconnect instructions are the major ones. "MY" followed by a space and your callsign sets that parameter. Incidentally, your custom settings can be saved to disk or cassette for recall at another time.



AEA's PK-64 PAKRATT.

The PK-64 offers the standard beacon mode. The beacon text (BTEXT) is input via the command mode. There's also a neat feature that utilizes a message called CTEXT. That stands for "connect text." With the options set properly, your PK-64 becomes a packet answering machine. When a station connects, the PK-64 sends a message of your choosing, normally inviting the connecting station to leave a message for you and then disconnect.

Perhaps if you attended the Louisville convention you heard the sound of the "connect siren" in the PK-64. It sounds a bit like an "end of the world" alarm—guaranteed to get the attention of even the soundest sleeper.

As in other modes, both a transmit buffer and a receive buffer can be activated. The receive buffer will hold about 20,000 characters. The review and editing features of the software allow you to manipulate the received text in any form you like. You have access not only to the QSO buffer but also to 10 message buffers. Text can be moved around from one buffer to another using the special editor. Actually it's a rather complete word processor that allows editing, saving, and loading.

The path used to connect is displayed in the header of connect messages. You can elect to stamp connected and monitored packets with just the time, the day and time, or the month, day, and time.

I can't conclude the discussion of features without telling you about two of my favorites. In the packet mode, the PK-64 will keep track of the number of unacknowledged packets you have sent. I frequently work over paths that are very marginal, particularly during daylight hours. The counter keeps me instantly informed in the event the packets start backing up. There is also an on-screen oscilloscope showing mark and space tones (more of a gee-whiz feature than it is useful). A perfectly-tuned signal makes the pattern look just like it should.

I'd like to switch into overdrive for a moment and talk about using the PK-64 on HF. The unit I tested included the optional HFM-64 module. It is a modem that uses the same technology present in the CP-1 computer patch. Normally, for the AFSK signals used on VHF operations a much simpler modem will work quite well. With the reduction in signal-to-noise ratios and additional interference present on the low frequencies, such simple modems don't perform well.

I've read many accounts of high frustration levels encountered by others trying to tune packet signals on the popular 20-meter packet frequency (14.103 MHz). I've done a limited amount of work there and have found it to be much more difficult than working on VHF.

Preparing to be quite skeptical, I connected the PK-64 to an R-600 receiver—not the best or easiest radio to tune for FSK signals. A quick check of the frequency revealed packet activity and I went to work tuning it in. Just as with the CP-1, the HFM-64 module made accurate tuning of the signal quite easy. I had my first packet station tuned in and printing within 30 seconds! Appropriately, it was Hank W0RLI's bulletin board. I enjoyed many other QSOs with similar ease in tuning. The only problem I had was the "bursty" nature of the packet signal as opposed to the continuous tone from a RTTY station.

If this were all the PK-64 did, it would have to be one of the best values in amateur radio today. But you must not forget that it works equally well on CW, RTTY, ASCII, and AMTOR. With the unit hooked up to my 2AT, I particularly liked being able to operate packet and traditional RTTY from one setup. We have several RTTY mailboxes on 2 meters in addition to the packet activity. All I had to do to switch between the two modes was to go to the option menu, select HF for band (setting the modem to standard mark and space frequencies), and then go back to the main menu and select RTTY mode.

Take a good look at the PK-64. For maximum effectiveness, I highly recommend the optional HFM-64 module. Both pieces come to about $320 total amateur list. For those without a Commodore 64 and not well equipped for assembling a TAPR TNC-2 from the ground up, AEA has introduced the PK-80. *73* will keep you posted on the latest developments.

Information on the PK-64 PAKRATT system is available from *Advanced Electronic Applications, Inc., PO Box C-2160, Lynnwood WA 98036; (206)-775-7373.*

Jim Grubbs K9EI
Springfield IL

CW TRAINING FOR THE APPLE

Learning Morse code has always been one of the less enjoyable steps in obtaining a ham ticket. C.W. Tutorsoft and C.W. Testmaster, written for the Apple II family of computers by Twin Oaks Associates, can make learning "the code" a rather enjoyable experience, especially if you or someone you know is one of the growing number who are attracted to amateur radio after being first exposed to the world of computers.

The user's guide and study manual supplied with the program state that C.W. Tutorsoft and its companion, C.W. Testmaster, are compatible with Apple II, II+, IIc, and IIe computers having a minimum of 48K of RAM and one disk drive. The program will also run on an Apple III computer using a pre-booted emulator. An Apple IIe system was used for this evaluation, throughout which the programs performed flawlessly. For those of you interested in the finer details of the software, these programs utilize the DAVID-DOS disk operating system licensed from David-Data, Inc., to provide fast disk access during program execution.

Written by Dr. Thomas F. Linde KZ0T, C.W. Tutorsoft is an exceptionally fine training program which trains the user by combining the audible CW tones with characters printed on the Apple's high-resolution screen as the various groups of characters are taught. This method is in contrast to the usual audio-cassette method of a "teacher" speaking the character name before and after the CW version. This visual/aural approach seems much more natural since in most cases an operator will write or type a CW message as it is received.

The program is designed to grow with the user as he/she becomes more proficient. Each program section (or Focus Menu, as the author calls them) allows the user to vary the speed and pitch of the CW while tackling various types of lessons. These menus will serve the would-be Novice or the Extra-class operator alike, offering four major areas of study: (1) the standard alphabet lessons and drills; (2) small, medium, and large or complex words to teach word recognition; (3) callsign recognition to prepare for FCC code tests; (4) QSO phrases to help with on-the-air "conversation" and again to make the FCC exams easier. Each section allows the user to select either Novice, General, Extra, or "Good Grief!" speeds to study the code.

C.W. Tutorsoft is an ear-training program. Within each review, the user must type the received letter or phrase on the keyboard. The program ignores any response entered prior to the completion of the material being sent. In each review, the program randomly sends you the Morse-code material contained in the study section preceding it. Your task is to type what you've just heard onto the keyboard. In each review, the program scores your performance and will send you on to the next lesson if your score exceeds the passing mark.

The next step up from C.W. Tutorsoft is its companion program, C.W. Testmaster. Following much the same ear-training technique as C.W. Tutorsoft, Testmaster goes a step beyond by providing users with an opportunity to copy various random QSO-type drills. Additionally, the program provides two distinct QSO messages which the user is tested on. One is a randomly-generated message which draws 13 specific pieces of information from a data pool of appropriate possibilities. The second QSO message is programmable, allowing the user to select his/her own variables for the drill. Both of the QSO exercises are followed by a completion quiz to test the student's understanding of the material presented.

Both C.W. Tutorsoft and C.W Testmaster are well-written, well-documented programs. Each sells for $30.00, a reasonable price especially when compared to other computer-aided instruction programs for the Apple. A minor drawback attributed to the use of a customized disk operating system is the inability of making backup copies of either program. Before purchasing either program, you may want to contact the folks at Twin Oaks to check on their policy about backups. All in all, I think you will find these programs extremely useful in learning CW for the first time or preparing to upgrade to the General- or Extra-class license.

For further information on these products, contact *Twin Oaks Associates, Route 5, Box 37, Knoxville IA 50138; (515)-842-6256.*

Tim McDonough WD9EDT
Springfield IL

G.W. MORSE KEYS PEP/B CONVERSION MODULE

There are many reasons why it is more useful to be able to read peak envelope power rather than rms power on your output or incident power meter.

If you are running full legal power you need to know what your PEP is if you are to be sure you are within the 1500-Watt PEP limit. If you are running less than that it is still very useful to be able to adjust your drive or mike gain to the point where your final is just producing maximum peak power on speech. Any drive past that point is likely to result in some splatter and distortion (and wear and tear in your finals).

The movement and the needle of your forward power meter have too much inertia to be able to follow speech patterns, so the reading you normally get on speech as the needle swings up and down doesn't mean much. You can assume that if the needle bounces to about 50 Watts as you talk, you probably are producing about 100 Watts peak output. If you make a long "AHHHH" into the mike, it will probably read close to 100 Watts. But this is all guesswork. Most people seem to believe the needle should bounce to full output power as they talk—hence the large number of wide splattering signals there are around.

I have several power and swr meters built into the rig and antenna-matching units, so buying yet another meter just to be able to read PEP was not a welcome prospect. I saw an ad from Amateur Accessories (United Kingdom) for a conversion module that would convert any forward power meter to read PEP, so I sent for one. It came in a couple of weeks from G.W. Morse Keys in Wales.

The whole thing is built on a printed circuit board 2.25 inches long × 1.25 inches wide and attaches with a single mounting screw. On the board is one integrated circuit and about 20 passive components. It requires a dc input of from 3 to 15 volts (the calibration is unaffected by voltage change) and takes about 1 milliamp. The manufacturer says that three heavy-duty AA cells in series would run it for about 9 month's continuous use, or about three years if switched off when the rig is not in use.

On the board, there are two calibration resistors in series which replace the movement of the existing meter. The voltage generated across these is applied to an amplifier which charges a capacitor through a diode. A second amplifier drives the meter. The total gain is unity, with 100% negative feedback.

The installation instructions are very easy to follow, and a diagram is supplied showing how to use a DPDT switch to remove the dc input and restore the meter to normal use. I did not bother to do this, as on key-down CW or on the "lock" position for adjusting the rig, rms power and PEP are the same (so I can meausre rms anyway) and I am taking 12 volts dc from the rig.

I installed the board in a Dentron MT-3000A antenna tuner. There is a space of about $^5/_8$ inch below the chassis, shielded from stray rf, so one hole in the chassis for mounting and one in the back to take the dc cable took only a few minutes. I just cut the existing orange lead from switch to meter in the 3000A and soldered the leads from the PEP/B to the exposed ends. This makes it easy to restore the 3000A if I want to, by just joining the orange leads together again. This kind of technique saves a lot of notes in the manual. A screening board the same size as the PCB is supplied to protect the unit from stray rf if it is installed close to rf fields. I put it on just so that I would know where it is in the future.

The preset pots for calibration were set during manufacture at halfway, and this tuned out to be almost correct for the 200-microamp meter used in the 3000A. Calibration was quite smooth and easy (you just make it read the same on key-down as it did before you dabbled). When you talk, the needle rises quickly to the peak reading and stays there. When you cease talking it decays slowly, and one tap on the mike puts it right back to peak. As far as I can see it works just as advertised.

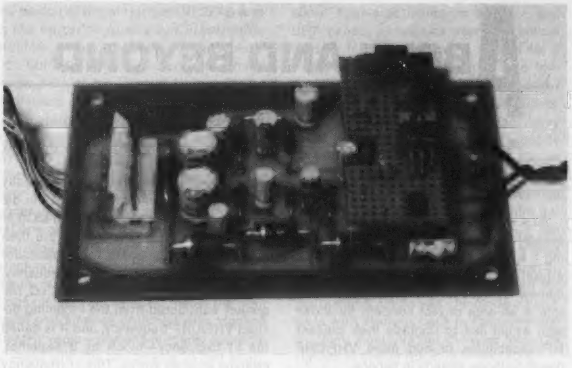
It costs 13.75 English pounds including postage and packing (US$17.00 at this time).

For more information, contact *G.W. Morse Keys, 4 Owen Close, Rhyl, Clwyd, Wales.*

Bob Eldridge VE7BS
Pemberton, British Columbia

WA1GRC TPS-1

The WA1GRC TPS-1 is a twelve-volt-dc power-supply kit for the TAPR (Tucson Amateur Packet Radio) terminal node controller and compatibles. The TNC-1 comes equipped for ac operation only via a power transformer which attaches to the TNC circuit board with a seven-pin conector. The WA1GRC TPS-1 plugs into the TNC power connector in place of the plug from the power transformer. When an 11-to-14-volt-dc power source is applied to the TPS-1, the TNC operates as usual. Using 12 volts dc, the TNC draws about 0.75 Amps.



The WA1GRC TPS-1. The perfboard assembly is a modification which is explained in the text.

The main feature that separates this dc power converter from other systems devised to power the TNC from 12 volts is that no modifications to the TNC are required. No components have to be changed and no traces have to be cut. It just plugs in.

In fact, if the TNC's five-volt regulator is mounted on the TNC's circuit board, the transformer can be removed entirely. However, if the regulator is mounted off the circuit board and wired to the transformer's connecting plug, the transformer must remain, and the connecting plug from the transformer is plugged into a connector on the TPS-1. Alternately, the regulator wiring may be disconnected from the transformer plug and wired to another plug, which is then inserted into the TPS-1 connector.

Theory

The TPS-1 contains voltage-dropping, switching, and doubling circuits. The 11-to-14-volt-dc source is dropped through four diodes to provide about 10 volts dc. The dc source is also switched through a PNP/NPN transistor pair feeding the voltage-doubling circuits to provide the +25 volts and −25 volts (maximum) needed to run the RS-232 port on the TAPR TNC. Of course, the TPS-1 output voltages will vary slightly depending on the input voltage and load characteristics.

The TPS-1 output voltages are fed to the TAPR TNC's on-board regulators to provide the regulated power necessary to operate the board.

Assembly

The WA1GRC TPS-1 was designed by Gary Field WA1GRC and is sold by him as either a complete kit or a bare circuit board. I ordered the complete kit, and it arrived by first-class mail a few days later.

The instruction manual is a few pages long and contains brief assembly instructions, a board layout diagram, and a schematic. The assembly went smoothly, however, I did notice some inconveniences with the instruction manual which, if corrected, would decrease assembly time.

Assembly depends on both the board layout diagram and the component list (which are on different pages), and I found it bothersome to flip back and forth each time I soldered a few components to the board. The resistors are referred to by value, and their color code is not mentioned; thus I had to look up the color codes to make sure I was installing them correctly. The circuit board is single-sided and does not contain markings on the component side, so care must be taken to follow the layout diagram carefully. With such a small kit these are minor annoyances, however, it would be a good idea to examine the kit carefully before beginning construction.

The components were mounted and soldered on the board, the connector was wired, and the dc power cable was attached. I was finished with assembly. A quick voltage check matched the values given in the manual, so I was sure that everything went well during assembly.

Operation

Being able to run the TNC from 12 volts dc has many advantages. Mobile operation is possible, and it can be a lot of fun to operate packet while traveling. Many repeater sites where TNCs are kept for use as digipeaters have battery backup systems, and now the TNC can take advantage of them.

In my particular situation, I planned to operate packet mobile and portable using 12-volt gel cells. I took my TAPR TNC-1, TPS-1, TRS-80 Model 100 computer, and handie-talkie along with me on vacation this past summer and was looking forward to operating packet during the trip.

I say "was" because on the first day of vacation the packet system suddenly went dead. The TNC seemed to be operating normally, but I was not able to communicate with it through the computer! Later, at the hotel, I diagnosed the problem to be with the TPS-1. One of the switching transistors had shorted out (probably due to overheating caused by poor air circulation in my restricted mobile setup) and the TNC was not getting the +25 and −25 volts it needed to run the serial communications port. As soon as I located the nearest Radio Shack, I replaced the switching transistors with higher Wattage ones in a Darlington network (see photo) and was back on the air in short order. From this experience, I can inform you that it is important to keep the TPS-1 ventilated.

Conclusion

The WA1GRC TPS-1 12-volt power converter for the TAPR TNC-1 is very useful for those desiring to operate a portable or mobile packet station. It is a pleasure to be able to operate packet independently of the ac line.

The complete kit sells for twenty dollars and the bare board sells for ten dollars. For more information, or to order, contact Gary Field WA1GRC, 5 Pluff Avenue, North Reading MA 01864.

Jonathan Mayo KR3T
Media PA

ABOVE AND BEYOND

Peter H. Putman KT2B
84 Burnham Road
Morris Plains NJ 07950

This month's column is prompted by several inquiries from local hams regarding the most cost-effective way to get a signal on the VHF bands. With times somewhat tight for the average amateur, this is an area of real concern for those who would like to upgrade their present HF capabilities or add more VHF/UHF bands to those already in service.

Consider the ham who purchases a working station for six meters with multimode radio, beam, and amplifier. Most likely he or she will have to shell out about $700–800 to come up with the 100-Watt station using a high-gain yagi. While this might not seem an unreasonable sum, it could very well be duplicated for each new bank added. A similar setup for 144 MHz, using a 100-Watt multimode and high-gain long-boom yagi, would come in about the same. 432 MHz would be similarly priced, and the newcomer quickly determines that the expense just isn't worth it.

But there is another solution: transverters. These magical little boxes allow the user to employ existing HF or VHF gear to access other VHF or UHF bands. If well designed, the performance is top-drawer, and all the best features of the existing HF or VHF transceiver are retained (i.e., scanning, memories, extra vfo's, SSB/CW filters, and so on).

"Well, where do I get one of these boxes?" muses the prospective VHFer. A glance through the current amateur mags turns up nothing—at least for those looking in the ads of the large retail outlets. All one sees is multimodes, multimodes, multimodes. Look again! There are at least four manufacturers of transverters engaged in actively selling their wares: Mutek, Ltd., and Microwave Modules, Ltd., of England, SSB Electronics of Germany, and Hamtronics of Rochester NY. There are other manufacturers of these devices, but their marketing efforts in this country are not on a level with these four. The European manufacturers sell their units as complete tested boxes—just plug 'em in and away you go. Hamtronics primarily markets their transverters as kits.

How does a transverter work? It's really quite simple: Incoming signals at the desired frequency are amplified by a MOS or GaAsFET device. These signals are then mixed with an on-board local oscillator (LO) to produce a difference frequency. This difference frequency is the LO frequency subtracted from the incoming desired VHF/UHF frequency, and it is called the i-f frequency—much as a superheterodyne receiver works. This i-f frequency is typically in the range of 28–144 MHz, depending on your needs and the converted band.

On transmit, the process works in reverse. The i-f frequency is mixed with the LO frequency to provide the desired transmit frequency. Again, MOSFETs are most commonly used in the mixer stages. Most transverters employ on-board rf power amplifiers to boost the converted transmit signal to about 10–15 Watts output. Newer models from some of the European manufacturers run more power (25 Watts), making them ideal for driving grounded-grid triode amplifiers, such as those using 8874 or 8877 tubes and even the new 3CX800 and 3CX1200 tubes.

"How much?" you ask. The answer is that you can purchase a transverter to take care of your particular band requirements for as low as $199. Now, that's a big difference from the price of the multimode mentioned before, and your performance may actually be better to boot. Consider this: A transverter is a linear device. What you put in, you get out (most of the time!). The only limitations are created by the performance of the individual devices used in the transverter, such as the MOS or GaAsFETs in the front end or the mixer devices. Still, it's an excellent way to add to your station complement without breaking the bank. And the additional savings could be towards a power amp or a mast-mounted preamp if desired.

Let's look at a typical transverter lineup. One very popular model is the Microwave Modules MMT 144-28. This unit takes 28-MHz signals and upconverts them to 144 MHz with 10 Watts of rf. Received signals at 144 MHz are downconverted to 28 MHz for reception on an HF receiver. First, transmitted signals at 28 MHz—typically 5–300 mW of drive—are fed into a dual-balanced mixer, typically employing 3N204- or 40822-type MOSFETs. Because this is a linear transverter, it doesn't matter what type of modulation is employed. The signal can be USB, LSB, AM, FM, and of course, CW. This low-level signal is mixed with the LO running at 116 MHz. The sum of these frequencies is amplified (144 MHz) in several stages, all of which are fairly tightly coupled and employ moderately high-Q tuning circuits to ensure adequate harmonic rejection. A power-amplified compartment then takes the low-level signal and amplifies in two stages to the rated 10–15 Watts output.

On receive, a 3N204 is typically used as a front-end amplifier. This device usually exhibits a noise figure (NF) at 144 MHz of about 2 dB, making it very acceptable for most VHF work. This signal is then mixed with the 116-MHz LO again and this time the difference of these frequencies (28 MHz) is amplified and fed back to the HF exciter. Tuning the band is accomplished by tuning the HF radio. In fact, these "black boxes," once tuned, can often be hidden away out of sight, as they usually require no further attention.

Similar units for 50, 432, and 1296 MHz also employ i-f frequencies of 144 MHz, to allow the person with the two-meter multimode to add another band. Again, the best features of the HF or VHF radio are retained by using transverters. Say you want to work some weak DX on 144 MHz, but a local QSO close to your frequency is causing QRM or splatter. You must switch in the SSB or CW filters on your HF rig! Try finding them on a multimode radio.

Here at KT2B, I use Microwave Modules on 144 MHz, 220 MHz, and 432 MHz—all driven by either an ICOM 740 or a Kenwood 430. On 1296, I employ an SSB Electronics LT23S transverter with an i-f of 144 MHz. Incidentally, the only multimode I use—a Kenwood TR-9000—is the "i-f" for the LT23S. This is primarily because of its scanning and fast stepped tuning, which are very useful when running up and down the band to find a QSO. Most of these units make provision for a separate antenna connection at the receiver input, allowing the use of an outboard preamp or switching through an external high-power amplifier if needed. I run mine straight through and use DPST antenna relays to bring external amplifiers in and out of the line. This is to allow QRP operation when desired.

What kind of radios can be used with a transverter? Models which have transverter provision already include Kenwood TS-520 series, 530, 820/830, 930/940, and 430. Also ICOM 730, 740, 735, 745, and 751. Many of the older Yaesu HF rigs, including the FT-101 series, made provision for an external transverter, and although the unit used tubes, the rf levels are sufficient for driving a modern-day transverter. The Collins KWM-380 has a transverter connection, and I can tell you that working 50-MHz sporadic E on a KWM-380 with a Mutek 50-MHz transverter is an experience you will not believe!

What if your radio doesn't have a transverter port? No problem. The best bet is to locate the output from the low-level rf stages before they go to the final amplifier assembly. Simply breaking this line and bringing it to a rear-panel connector, then running another line from a second connector back to the final gives you the desired connection. I employ this method on my ICOM 740 to obtain increased drive for the MMT-series modules. Jumpering the two connectors restores full HF transceive operation. On receive, use the normal antenna connector on your HF rig and connect to the 28-MHz i-f output jack on the particular transverter.

If your HF or VHF exciter runs 10 Watts or less, many of the transverter makers have 15-dB pads to drop the drive level low enough for the transmit mixer. Or, you can make one yourself out of six 2-Watt 100-Ohm carbon resistors. Connect them as shown in Fig. 1. This will dissipate most of the rf, leaving a small amount for the mixers to work with. The attenuator is generally employed with 144-MHz multimodes when converting to 50, 432, or 1296 MHz. Usually there is sufficient gain in the receiver i-f mixer to overcome the losses of this pad, especially when used in the transceive mode.

Other HF radios that could be used with this attenuator include the Ten-Tec Argonaut series, the older TS-130V, and almost any ICOM in the low-power position. Note also that all of the transverters currently available have built-in sensitivity controls to allow for a range of about 5–300 mW of drive, so you must not exceed 300 mW. When in doubt, use a pad. A 1-Watt signal padded down by 15 dB translates into about 50 mW of drive—more than adequate.

Newer modules promise increased band coverage. Microwave Modules has announced the MMT 144-28R, with GaAsFET front end and 25 Watts output power. In addition, there are two additional LO frequencies incorporated into the transverter to allow for simplex and ±600-kHz operation on FM. As presently configured, the coverage is only 144–146 MHz (the European two-meter band), but discussions with the US importer reveal plans to add a fourth LO to switch coverage up to 148 MHz to allow repeater use. Don't have a two-meter base-station rig for FM yet? One of the new transverters and the FM module for your HF radio will do the trick.

The key here is to get the maximum use from your already-purchased HF or VHF multimode radios. ICOM has announced the IC-1271 multimode for 1296 MHz, but it carries a retail price tag of almost $1000! For half the cost, a transverter could be bought that would do much the same thing.

An interesting development is the production of a 220-MHz transverter by SSB Electronics of Germany for the US market. This is not an allocation in Europe, so such a device is a bit of a gamble on the part of the folks from Iserlohn! Of course, Transverters Unlimited of Canada already markets such a device, based on the Microwave Modules design. For those who prefer to roll their own, Hamtronics of Rochester NY markets a full line of transverters for 50, 144, 220, and 432 MHz including a model that permits 28–30-MHz

SOURCES FOR TRANSVERTERS

Microwave Modules

The PX Shack
52 Stonewyck Drive
Belle Mead NJ 08502
(201)-874-6013

MMT transverters, converters, amplifiers

Spectrum International, Inc.
PO Box 1084S
Concord MA 01742

MMT transverters, converters, amplifiers

Transverters Unlimited
PO Box 6286
Station A
Toronto, Ontario, Canada M5W 1P3
(416)-759-5562

MMT transverters, converters, amplifiers

Mutek, Ltd., and SSB Electronics

The VHF Shop
16 South Mountain Boulevard
Mountaintop PA 18707
(800)-HAM-7373
(717)-474-9399

Transverters, converters, preamps, amplifiers

Hamtronics, Inc.

Hamtronics Corporation
65-D Moul Road
Hilton NY 14468
(716)-392-9430

Transmitting and receiving converters, preamps, amplifiers

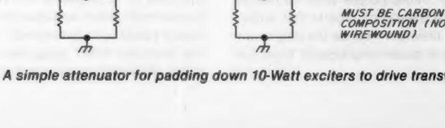


Fig. 1. A simple attenuator for padding down 10-Watt exciters to drive transverters.

operation from a 144-MHz i-f! The units are sold separately as a transmit converter and receive converter. A typical VHF transverter would cost about $120, based on the latest ads.

I often hear rumors that the big three in Japan (ICOM, Kenwood, and Yaesu) are planning to come out with transverters for the US market. These rumors would tend to be substantiated by the "transverter" accessory sockets and connectors found on many of these rigs. As of yet, I haven't seen a single one, but I can guarantee that if sales of the European and North American transverters increase by a sizeable amount, we'll have plenty of products to choose from in short order. Incidentally, I mentioned the Yaesu transverters for the FT-101 series; Kenwood also marketed transverters for 144 and 50 MHz for use with the TS-520S series. They make serviceable units if you can locate them at flea markets and hamfests. But for now, nothing from Japan.

If you feel so inclined, you can obtain a couple of B&W coax switches and select up to six transverters using 28-MHz i-fs! This is similar to a system I employ here, where 3 different bands are selected independently for the TS-430S. It makes rapid QSYing for prearranged schedules a real pleasure. And as was mentioned earlier, you can hide the boxes away if needed, to save on shelf space. All they require is 13.8 volts dc and some sort of keying line, unless you use the internal rf-sensed keying that many provide. The SSB Electronics LT23S provides an on-board attenuator to allow direct drive from a 10-Watt multimode 144-MHz transceiver.

What's coming down the pike? High-performance transverters for 50 through 2304 MHz, using GaAsFETs and diode mixers to improve dynamic range and noise figure. Transverters will be available for the new 902-MHz band shortly as well. Bandswitched crystal LOs will allow full coverage of the desired band, and of course, all-mode operation is possible on any band. I'll be reviewing some of these new models as they appear on the US shores. Look for reviews of the MMT 144-28R shortly.

Mailbox Department

This month we hear from Australia in the person of Roger Harrison VK2ZTB who is the editor of *Australian Electronics Monthly*, a slick general-interest publication not unlike *Popular Electronics* here. Roger tells of his interest in forecasting sporadic-E propagation on six meters and two meters and is very interested in the study published by Sid Lieberman WA2FXB which I mentioned several months ago. It would seem that there has been a surge in interest in this topic down under, and Roger has many clever observations pertaining to sporadic-E propagation. One in particular pertains to antenna stacking when working "scatter waves" (as he refers to them). Based on observations he and Rod VK2BQJ made, the optimum performance obtained with stacked 50-MHz yagis—working primarily sporadic E—was with the two beams 10 feet apart, or about ½ wavelength. Roger further observes that "antennas stacked one wavelength apart can often act to cancel scatter signals much of the time, as stacking for maximum plane-wave gain results in gain degradation for scatter signals."

Roger publishes the *6-UP* newsletter which contains much useful information about Aussie activities on the VHF and UHF bands, as well as several practical circuits for construction. A design for a five-element 50-MHz beam is also featured. It makes for good reading and I hope Roger will continue to forward issues from time to time. One last story which caught my eye was the attempt by Don Richards VK2BXN to work auroral scatter from the Antarctic during a scientific expedition. Apparently Don was to pursue a course that would take him under the auroral curtain, so he had the unique experience of trying to work both conventional back-scatter and front-scatter! Although Don was equipped with 100 Watts and a single yagi, he made no contacts with stations back in Tasmania and southern Australia but did hear faint CW signals at one of the appointed times.

Incidentally, the ship on which Don made his voyage was the *Dick Smith Explorer*, which I assume was the ship destined to tow an iceberg into Sydney Harbor some years back. What will those folks from VK-land think of next?

Until next month, see you Above and Beyond.

LETTERS

VITALLY IMPORTANT

I must strongly disagree with the opinion expressed by William Itter N9EWA in the November, 1985, "Letters" column. Though it is not the main thrust of his letter, Itter implies that the Novice-class license is essentially worthless, not only in its technical expertise, but in its privileges.

From personal experience I can say that one reason many people shy away from amateur radio is their fear of a long and involved test of radio theory. The Novice license serves as a relatively painless entry point to expose the newcomer to the exciting possibilities of amateur radio. Since the technical requirements of the Novice license are slight, the Novice should not expect to earn a wealth of privileges. By design, the privileges *are* limited. The idea is that once the Novice has had a taste of what ham radio is and has discovered how much more there is to do in this incredibly flexible hobby, he or she will be motivated to stay involved long enough to upgrade.

I agree that "an increase in our ranks is not going to come from either fewer restrictions or greater privileges," but the question of privileges is essentially irrelevant to enticing the newcomer to amateur radio. However, since amateur radio is continually changing, the privileges granted Novices should be periodically reviewed.

Another point Mr. Itter makes concerns the involvement of young children with computers. Most kids who become interested in ham radio get their start through the Novice license. Children as young as five have passed the exam. I wonder how many children would be turned away from ham radio by the elimination of the Novice license? How many five-year-olds do you know who could pass the Technician test?

Various radio journals have expressed their concern about the rising average age of the ham population. Do we want to aggravate this problem? We must realize that there is no exam to take before you use a computer. Computers are fascinating to children, who are exposed to them both at home and at school. But amateur radio is just as fascinating! Our problem is that we lack exposure. We need to work together to resolve this problem.

So, if we want lasting growth, maybe we should organize and pressure ham manufacturers to donate or discount radio gear to schools and youth groups. Of course, this would be pointless without the support of the amateur-radio community to develop and run the programs and clubs that would be needed. What good is a donated radio if it sits in a closet because nobody knows how to use it? Further, we must not elevate the entrance-level exam beyond the capabilities of young children. The Novice license is vitally important to the hobby.

J. Bruce Tinkler N9FJO
Barrington IL

FINE WORK!

Regarding the Nuller Bridge by Bill Vissers K4KI ("Wheatstones Are Not Crackers!", September, 1985): Fine work! The little gadget works perfectly and costs only a few dollars to build. I've made three of them so far, the last one combined with a 50-Ohm, 100-Watt dummy load. The bridge is excellent, as there is *no* rf being radiated while resonating the antenna or tuning the transmitter.

Barrie Coates VE7AQK
Peachland BC

GOOD OLD DAYS

About your answer to KK2W's letter in the November, 1985, issue. It's interesting that you and he have apparently divergent views about the Novice license and privileges—and that neither of you is right.

Want to know what's right? Maybe I'll tell you, but first I'll tell you the way things were in 1950. The Novice program was still new. As I recall, there were three license levels, four if you count the Technicians: Novice, Technician, General, and Advanced. (I'm omitting the Conditional license.) The Novice license was good for one year and was nonrenewable, the others good for five years and renewable.

You couldn't be a Novice for more than a year, and you couldn't be an Advanced until you had been a General for at least a year. I don't think there was a 20-wpm Extra ticket until 1951 or 1952. Novices had only CW privileges on 80m and maybe phone on 2m. The 15m band wasn't available to anyone yet. Generals had all bands for CW and phone on 10m, while Advanced licensees got it all.

What in Maxim's name is wrong with that system? Nothing that I can see. The Novices had incentive and the Generals had apprenticeship. I think that all the talk about incentive licensing wouldn't be necessary if that licensing structure had been maintained.

A. J. Massa W5VSR
New Orleans LA

One of the worst things the FCC has ever done to ham radio was when they made the Novice license renewable. How many "career Novices" do you think are in the ranks now? And how many will there be after the "super Novice" ticket is available? Seems to me that the renewable Novice license is an invitation to stagnation.—KW1O.

59 – 20 dB

"Improve Your Audio Report" (November, 1985) is good advice. Jim W2OZH has done an outstanding job analyzing and documenting the need for good audio and a better reporting system. His message is 599 (QRI 10).

However, amateur radio is still a process of establishing communications links in a variety of modes and media, not just high-power audio on the rag-chewer's bands. If RST is out of date, then so are Q signals. Three digits of RST are bad enough, let alone 5 digits of QRI! Let's leave RST to QRP and let's get good audio by the use of technology (better equipment, microphones, and level control).

Since when is hi-fi audio needed on ham radio? Better we concentrate on what to say and how to say it. Most of our commercial equipment will get the message through QRM and QRN.

When I'm on phone I can say, "Your audio is clear and understandable and pleasant to hear. How do I sound?" And you can bet he'll tell me *in detail* what is wrong with my audio! Then there are those contests where everyone is 59 unless you can't hear them.

Bravo, Jim, but I'll wait for some other suggestion that can beat your QRI.

Staff Stafford NJ8F
Delaware OH

Q & A

December, 1985's "QRX" column talks about "The Final Exam" series by Dick Bash. Now that the ARRL includes FCC questions *and* answers in their study guides, I hope that you will refer to the League as "infamous" as well or you will be guilty of the worst kind of discrimination!

Clyde Grubbs WB0TYR
Jamestown ND

Dick Bash asked hams to write down questions and answers from the exam as they walked out of the testing room; his "study guides" were simply verbatim copies of the FCC exam. In fact, Dick advised examinees to ignore the warning printed on their test—the warning that said, "An attempt . . . to copy or divulge examination questions is a violation of FCC rules for which penalties are provided."

Under the new testing structure, all of the questions for each element are in the public domain. Since there are several hundred potential questions for each exam, it's virtually impossible to memorize enough material to pass a test. The League (and others) publishes study guides with answers to help an applicant understand the information he or she needs to upgrade; this is totally different from the verbatim regurgitation of answers by Bash's graduates.

Clyde, you mentioned that you teach a Novice class every fall. Let me ask you this: Do your students pass their exams because they understand the subject or because they've memorized twenty answers?—KW1O.

RTTY LOOP

Marc I. Leavey, M.D. WA3AJR
6 Jenny Lane
Pikesville MD 21208

Well, I do get taken aback once in a while, and a phone call I recently received did just that. Frank Fox WA6KGD telephoned me to indicate that the news of the death of Super-RATT was a bit premature. It seems that he has assumed the distribution of this program, written for the Apple II, II+, IIe, and IIc. It requires 48K of RAM and one disk drive and interfaces with an outboard terminal unit and AFSK generator using TTL-level signals. He tells me that the program is available for $79 from him at 186 Isabella Street, Hayward, California 94544. If you like, you may reach him by telephone at (415)-538-7832 after 5:00 pm California time, and on weekends. Do I have to remind you to tell him you saw it here? I thought not!

Now, the planned RTTY computer this month is the Radio Shack Color Computer®, also known as the TRS-80C or the CoCo. This little gem of a computer has caught the eye of many a ham, both for its economy (I have seen the 16K model selling for less than $90 at my local store) and for the ease of programming the 6809 CPU.

Unfortunately, this ease of use, economy, and convenience is not matched with a plethora of RTTY programs. In fact, only two commercial programs were mentioned in all of your input.

Kantronics, which produces a version of their Hamsoft program for most of the popular microcomputers, markets a ROM-cartridge version for the CoCo. One of you wrote with some observations: "Operationally, it requires TTL signals, not RS-232. I had no trouble connecting it to my [terminal unit] and [transceiver]. It has a built-in parallel printer port, but no documentation on using it outside of the program. [The] documentation is only adequate; no schematic [is supplied]. Supports CW from 5 to 99 wpm, RTTY speeds from 60 through 132, ASCII from 110 to 300 baud. There are a number of useful configuration/operating options, 10 loadable/editable message buffers, and a type-ahead buffer. It runs with a 4-way split screen on a normal 32×16 CoCo screen. On the good side, it does work. I found no bugs, per se. The above features are nice.

"Many 'little things,' though, add up to a poor implementation of a good idea. The time-of-day clock loses about 1 minute in 8 hours. The control functions on the keyboard are easy to remember, but impossible to type one-handed (like <CLEAR><S>). There is no 'quick-load' message buffer for use during QSOs. You cannot clear the type-ahead buffer. The system is much too susceptible to noise. Even low-level QRN makes the CW-receive function useless. RTTY seems a little better, but still less noise immune than seems right for a CoCo. The receive CW speed must be calculated only on dit time; sending at the receive speed is almost always too fast. The CW algorithm lacks stability. With QRN it will jump from 18 to 88 wpm in one character time—one QRN 'pop' wipes out two characters, usually.

"I needed a program, so I am glad I have it, but I know I'll be writing one of my own as soon as I have the time." Ah, yes, the time; don't we all wish we had it!

Contrast that firmware product with another one that is far and away the most popular choice, a program marketed by our old friend Clay Abrams called NEWRTYCW. This program, written by Mike Meeks WA4VEF, is a machine-language program which features transceive operation in CW, RTTY, and ASCII. Four "station buffers" are maintained, each one 254 bytes in length. These can be loaded at the beginning of a session. There are two large buffers, a "keyboard" buffer and a "receive" buffer, both of which are 12K in a 32K CoCo. These buffers can be typed into or printed out on the station printer, as the need dictates. Full ranges of CW and RTTY speeds are supported, and the program interfaces through the "bit-banger" RS-232 port on the back of the CoCo.

This versatile piece of software is available from Clay Abrams Software, 1758 Comstock Lane, San Jose, California 95124. While I don't have a current price, I am sure that Clay would be glad to help you.

Now, there are a few problems. Unlike every other computer program mentioned here to date, this one seems to cause the hacker instinct to emerge. NEWRTYCW is supplied on tape only, and Clay tells me that there are no plans to release a disk version. Although transferring the tape program to disk does not allow disk I/O or other disk-based advantages, it does promote faster, more convenient loading with less chance of a load error. To that end, many—no, most of you—who wrote with your praises of the program included your own scheme for transferring this self-booting copy-protected program to disk.

I wrote to Clay and asked him if he minded my publishing such a scheme, and he said that he did not mind, but that he could not, of course, endorse or support such a patched program. So, if you have purchased a copy of NEWRTYCW, read on.

Of all the schemes I looked at, the best is to offset-load the program, defeating the auto-boot, and then move it back where it belongs for use. The most elegant of these is shown in Program listing 1. Submitted by Rick Koch WB1BRR of Derry, New Hampshire, it is a short loader routine appended to the front of NEWRTYCW. The modified program may be SAVEMed to disk, from which it can be LOADMed and EXECed without problem.

```
2077      1A 50     ORCC #$50
2079      8E 208E   LDX  #$208E
207C    108E 0109   LDY  #$0109
2080      EC 81     LDD  X++
2082      ED A1     STD  Y++
2084      8C 3F04   CMPX #$3F04
2087      23 F7     BLS  $2080
2089      1C AF     ANDC #$AF
208B      7E 0109   JMP  $0109
```

Program listing 1.

While Program listing 1 is the assembly version of the loader, a more practical solution for many users will be Program listing 2. This Basic program will, when run, put the loader in memory at the correct location. To use this scheme, enter the program and save it to disk as PATCH.BAS. Then put the tape with NEWRTYCW in the recorder. Type RUN"PATCH and when the OK prompt comes back, type CLOADM "NEWRTYCW",&H1F85. The tape will load, and you will get another OK. At that point, type SAVEM"RTTY",&H2077, &H3F04,&H2077 and you will be all set. Now, to go onto RTTY, just type LOADM"RTTY and EXEC the program.

My thanks to Rick Koch, Ernie Marquez KP4EIH, Rob Rochelle WA4DAZ, George Fundis KD4RC, Calvin McCarthy VE3LMP, Fred Wood WB3JKC, Gary Bender, and, of course, Clay Abrams K6AEP, along with the many others who expressed an interest in RTTY on the CoCo.

The shack of the month this month is a bit unusual. Instead of showing a shack with a ham sitting there, this is really a ham *in* his shack! Clay Abrams sent along the photo of his new computer shack, with quite a display on the screen! I'll say this, Clay, it is different!

The Pittsburg (Kansas) Repeater Organization, Inc., graced my mailbox with their bulletin, *The Procrastinator*, this month. Looks like an active group out there, with a repeater on 146.94 MHz and all kinds of functions. Of RTTY note in this bulletin is another version of the increasingly popular AFSK generator based on the XR-2206 function generator. Hams in the Pittsburg area may wish to listen to .34/.94, or contact PRO, Inc., at Box 1303, Pittsburg, Kansas 66762.

Is packet a part of RTTY, or is it a separate interest? I ask because I have been checking into HAMNET on CompuServe lately, and much, if not all, of the discussion there in the RTTY/AMTOR/Packet section is on the growing topic of packet radio. A buddy of mine has demonstrated just what can be done with packet, and I am impressed. Other than a short tutorial presented here a few months back, though, I have not covered much in that camp. Let me know what you think, yea or nay, for future coverage of this new topic.

Shack of the month: K6AEP.

```
10 ' PATCH.BAS
20 ' RTTY.LOOP  FEB 86
30 ' MARC I. LEAVEY, M.D.
40 ' THANKS TO RICK KOCH  WB1BRR
50 PCLEAR 8
60 M=&H2077
70 READ D$
80 IF D$="END" THEN END
90 POKE M,VAL("&H"+D$)
100 M=M+&H1
110 GOTO 70
120 DATA 1A,50,8E,20,8E,10,8E
130 DATA 01,09,EC,81,ED,A1,8C
140 DATA 3F,04,23,F7,1C,AF
150 DATA 7E,01,09
160 DATA END
```

Program listing 2.

Interested in copying commercial RTTY stations? Joerg Klingenfuss has brought out the fourth edition of his *Guide to Utility Stations* which is about ten percent bigger than last year's! He's even including VLF and LF stations now, plus meteorological FAX stations, and more. The guide sells for DM60 (you're on your own for conversion to dollars) and is available from Klingenfuss Publications, Hagenloher Str. 14, D-7400 Tuebingen, Federal Republic of Germany. You know whose name to drop, right?

A few months ago I mentioned the new CoCo keyboard that was appearing in stores. Selling for $4.95, this little wonder sports four keys not on the original CoCo keyboard: CTRL, ALT, F1, and F2. I wondered out loud about some software to put these keys to use. Well, another old friend, Bob Rosen, mentions that Spectrum Projects, PO Box 21272, 93-15 86th Drive, Woodhaven NY 11421, is selling a program that allows these four keys to add a 9600-baud POKE, text-screen dump, LIST command, and cold start. The CoCo keyboard enhancer is supplied on disk for $14.95.

Response on the reprint series has been most gratifying, with many of you passing along individual stories of how some of the information supplied has helped you to get on RTTY. If you would like a list of reprints available, each of which is extracted and updated from material published in this column over the past nine years, send a self-addressed, stamped envelope to me at the above address. Each reprint is $2.00, in case you are curious, but send for the list first, OK?

Don't be shy about including other comments or questions when you ask for the reprint list. I read every one and try to answer as quickly as I can. Quite a few of you have found that answers to questions submitted on CompuServe have appeared on the same day the question was sent! Mail to the above address, or EasyPlex to ppn 75036,2501. I look forward to your comments, questions, and information.

Many of your questions about specific pieces of commercial RTTY gear have been forwarded to the respective manufacturers of the equipment, but the responses have been slow in coming. I don't know if any of them read this column, which clearly is one of the longest (*the* longest?) running RTTY columns, but feedback from them is nil, folks. I can only print what information I receive, so if I am not saying much about a converter, node controller, computer, or whatever, it is *not* because I am biased or ignoring that line; it's because I have no information.

Information to share? Well, there certainly will be some next month. I know because I see some of it sitting on the clipboard already. If you want to see what it is going to be, don't miss the next edition of "RTTY Loop."

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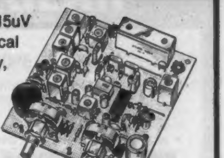

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144-146	28-30
145-147	28-30
144-144.4	27-27.4
146-148	28-30
144-148	50-54
220-222	28-30
220-224	144-148
222-226	144-148
220-224	50-54
222-224	28-30

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Kit with Case	$49
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Kit with Case	$59
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435-437	28-30
432-436	144-148
432-436	50-54
439.25	61.25

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	28-29	145-146
	28-30	50-52
	27-27.4	144-144.4
	28-30	220-222*
	50-54	220-224
	144-146	50-52
	50-54	144-148
	144-146	28-30
For UHF, Model XV4 Kit $99 Wired $169	28-30	432-434
	28-30	435-437
	50-54	432-436
	61.25	439.25
	144-148	432-436*

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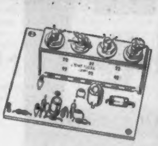

Model	Tuning Range	Price
HRA-144	143-150 MHz	$49
HRA-220	213-233 MHz	$49
HRA-432	420-450 MHz	$59
HRA-( )	150-174 MHz	$54
HRA-( )	450-470 MHz	$64

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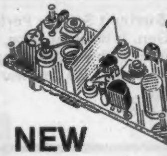

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LNW-220	200-270 MHz	$19	$34
LNW-432	400-500 MHz	$19	$34

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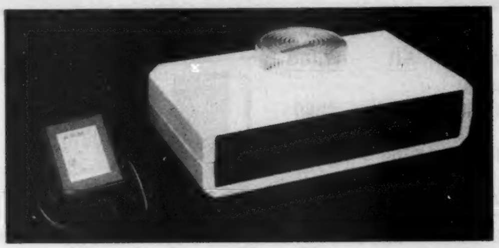

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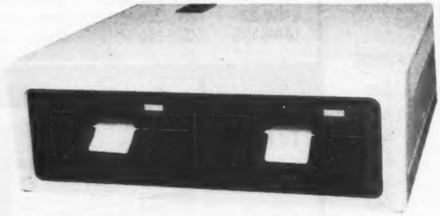

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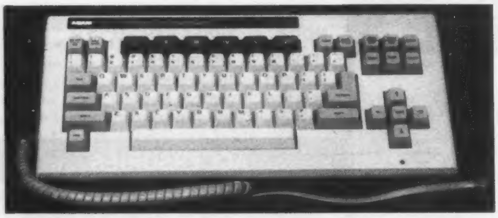

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A super high performance FM wireless mike kit! Transmits a stable signal up to 300 yards with exceptional audio quality by means of its built in electret mike. Kit includes case, mike, on-off switch, antenna, battery and super instructions. This is the finest unit available.

FM-3 Kit	$14.95
FM-3 Wired and Tested	19.95

Color Organ

See music come alive! 3 different lights flicker with music. One light each for, high, mid-range and lows. Each individually adjustable and drives up to 300 W. runs on 110VAC.

Complete kit, ML-1
$8.95

Video Modulator Kit

Converts any TV to video monitor. Super stable, tunable over ch 4-6. Runs on 5-15V accepts std. video signal. Best unit on the market! Complete kit VD-1 $7.95

Led Blinky Kit

A great attention getter which alternately flashes 2 jumbo LEDs. Use for name badges, buttons, warning panel lights, anything! Runs on 3 to 15 volts.

Complete kit, BL-1
$2.95

Super Sleuth

A super sensitive amplifier which will pick up a pin drop at 15 feet! Great for monitoring baby's room or as general purpose amplifier. Full 2W rms output, runs on 6 to 15 volts, uses 8-45 ohm speaker.

Complete kit, BN-9 $5.95

CPO-1

Runs on 3-12 Vdc 1 wall out, 1 KHZ good for CPO, Alarm, Audio Oscillator. Complete kit $2.95

FM Wireless Mike Kit

Tansmits up to 300' to any FM broadcast radio, uses any type of mike. Runs on 3 to 9V. Type FM-2 has added sensitive mike preamp stage.

FM-1 Kit $3.95 FM-2 Kit $4.95

Whisper Light Kit

An interesting kit, small mike picks up sounds and converts them to light. The louder the sound, the brighter the light. Includes mike, controls up to 300 W, runs on 110 VAC.

Complete kit, WL-1
$6.95

Tone Decoder

A complete tone decoder on a single PC board. Features: 400-5000 Hz adjustable range via 20 turn pot, voltage regulation, 567 IC. Useful for touch-tone burst detection, FSK, etc. Can also be used as a stable tone encoder. Runs on 5 to 12 volts.

Complete kit, TD-1 $5.95

Universal Timer Kit

Provides the basic parts and PC board required to provide a source of precision timing and pulse generation. Uses 555 timer IC and includes a range of parts for most timing needs.

UT-5 Kit $5.95

Mad Blaster Kit

Produces LOUD ear shattering and attention getting siren like sound. Can supply up to 15 watts of obnoxious audio. Runs on 6-15 VDC

MB-1 Kit $4.95

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Produces upward and downward wail characteristic of a police siren. 5 W peak audio output, runs on 3-15 volts, uses 3-45 ohm speaker.

Complete kit, SM-3 $2.95

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Runs on 5-15 VDC. Low current (25ma) 1 min/month accuracy TB-7 Kit $5.50

TB-7 Assy $9.95

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TR-1, RF sensed T-R relay kit	6.95

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HAM HELP

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Help! I've been searching everywhere for information on how to do a "fast-scan" modification to my ICOM IC-02AT. Can anybody help me?

Michael Gasser KA8WPC
7630 Reitz Rd. #144A
Perrysburg OH 43551

I am looking for a Kenwood DG-5 digital display for my TS-520SE.

Mike Weir
310 Niska Rd. #104
Downsview, Ontario
M3N 2S3 Canada

I would like to obtain a copy of the review of the Realistic DX-400 shortwave receiver which appeared in the *1984 World Radio and TV Handbook*, as well as a review of the ICOM R-70 which appeared in the same issue. Also, does anyone have information on broadbanding the ICOM IC-280?

Scott Harvey
N. 5011 Idaho Rd.
Newman Lake WA 99025

I would like to borrow a copy of the manual or the schematic for a Clegg 22'er Mark II. Has anyone converted this unit for FM?

Greg Magarie WA1VIL
33 Barnesdale Road
Natick MA 01760

I need a TA-7153-P 14-pin integrated circuit to repair my receiver. I have been told that this part is used in many Toshiba television sets. Can anyone help me?

H. Marhoff
36 980 7th St. NW
Largo FL 33540

Has anyone come up with a Commodore 64 peripheral that produces SSTV graphics and text? Also, I need a schematic for a Gonset G-50 6m rig. I will gladly pay shipping and copying costs.

Kenneth Johnson WA4TOP
8 Fairview Drive North
Sun Air
Haines City FL 33844

I would like to get in touch with anyone who uses a Timex 2000 or a Timex 2068 microcomputer to exchange ideas and programs.

Manos Darkadakis SV1IW
Box 23051-112
10 Athens, Greece

I need a service manual or an operations manual for an Allied Communications model A-2515 receiver. I'll pay shipping and copying costs.

Wendell Titmus
32115 Hays Road
Warren MI 48093

TEST EQUIPMENT

RE-CONDITIONED AND LAB CALIBRATED

HP 606A SIGNAL GENERATOR, 50 KHZ TO 65 MHZ, RF OUTPUT 0.1 MV TO 3V IN 50 OHMS, CRYSTAL CALIBRATOR, 400/1000 HZ MODULATION $375.00

HP 608C SIGNAL GENERATOR, 10 MHZ TO 480 MHZ, 0 TO 0.1 MV TO 1V RF OUTPUT INTO 50 OHMS, AM/CW PULSE, OR 400/1000 HZ MODULATION CALIBRATED ATTENUATOR $345.00

HP 608D SIGNAL GENERATOR, 10 MHZ TO 420 MHZ AM, CW OR PULSE OUTPUT, 400/1000 HZ MODULATION OMV TO 5V INTO 50 OHMS, CALIBRATED ATTENUATOR $295.00

TS-510A/U SIGNAL GENERATOR, 10 MHZ TO 420 MHZ MIL/SPEC MILITARY VERSION, SAME AS HP608D $295.00

HP614A SIGNAL GENERATOR, 900 MHZ TO 2100 MHZ, INTERNAL OR EXTERNAL PULSE OR FM MODULATION, 0.5 MV TO 1V INTO 50 OHMS, CALIBRATED OUTPUT $345.00

HP 616A SIGNAL GENERATOR, 1.8 GHZ TO 4.2 GHZ 0.1 MV TO 1V INTO 50 OHMS, CALIBRATED OUTPUT INTERNAL, EXTERNAL PULSE, FM MODULATION $375.00

HP-618B SIGNAL GENERATOR 3.8 GHZ TO 7.6 GHZ, 0.1 MV TO 1V INTO 50 OHMS, CALIBRATED OUTPUT, INTERNAL, EXTERNAL PULSE OR FM MODULATION $375.00

SG-557/URM-52 SIGNAL GENERATOR 3.8 GHZ TO 7.6 GHZ, MIL/SPEC MILITARY VERSION, SAME AS HP618B $325.00

HP620A SIGNAL GENERATOR, 7 GHZ TO 11 GHZ, CALIBRATED OUTPUT INTERNAL, EXTERNAL, PULSE, FM MODULATION $450.00

HP 626A SIGNAL GENERATOR, 10 GHZ TO 15 GHZ INTERNAL, EXTERNAL, PULSE, SQUARE WAVE, FM MODULATION CALIBRATED OUTPUT, 10 MW TO 1 PW $650.00

HP 628A SIGNAL GENERATOR, 15 GHZ TO 21 GHZ, CALIBRATED OUTPUT 10 MW TO 1 PW INTERNAL, EXTERNAL, SQUAREWAVE, PULSE, FM MODULATION $650.00

URM-25 MILITARY SIGNAL GENERATOR, 10 KHZ TO 50 MHZ, RF OUTPUT 0 MV TO 2 VOLTS AM/CW 400/1000 HZ MODULATION, 50 OHM STOP ATTENUATOR, SMALL PORTABLE UNIT $245.00

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RG11U 96% shield, 75-ohm mil spec	25¢/ft.
RG8U 96% shield, mil spec	$29.95/100 ft. or 31¢/ft.
RG6A/U double shield, 75-ohm	25¢/ft.
RG58AU stranded mil spec	12¢/ft.
RG58 mil spec. 96% shield	11¢/ft

LOW LOSS FOAM DIELECTRIC

RG8X 95% shield	$14.95/100 ft. or 17¢/ft.
RG59/U 70% copper braid	9¢/ft.
RG8U 80% shield	18¢/ft.
RG58U 80% shield	07¢/ft.
RG58U 95% shield	10¢/ft.
RG59U 100% foil shield, TV type	10¢/ft.
RG8U 97% shield 11 ga. (equiv. Belden 8214)	31¢/ft.
Heavy Duty Rotor Cable 2-16 ga, 6-18 ga	36¢/ft.
Rotor Cable 8-con. 2-18 ga, 6-22 ga	19¢/ft.

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Amphenol Pl-259	79¢
PL-259 Teflon/Silver	$1.59
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PL-258 Double Female Connector	98¢
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Reducer UG-175 or 176	10/$1.99
UG-255 (PL-259 to BNC)	$2.95
Elbow (M359)	$1.79
F59A (TV type)	10/$2.15
UG 21D/U Amphenol Type N Male for RG8	$3.00
BNC UG88C/U, male	$1.25
3/16 inch Mike Plug for Collins etc	$1.25
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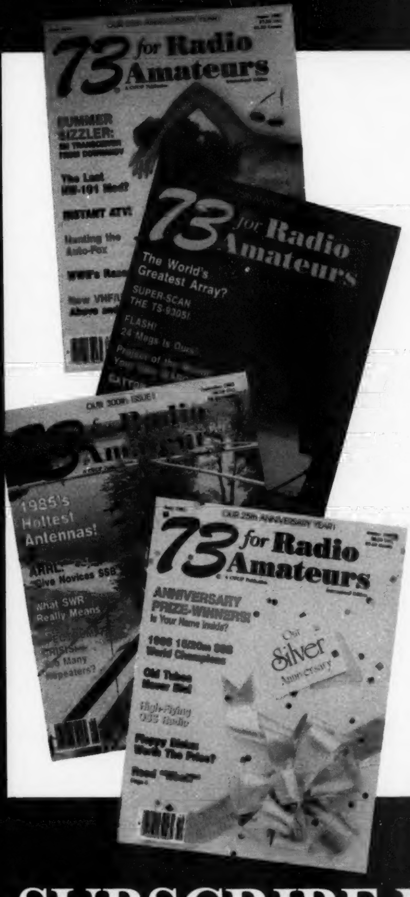
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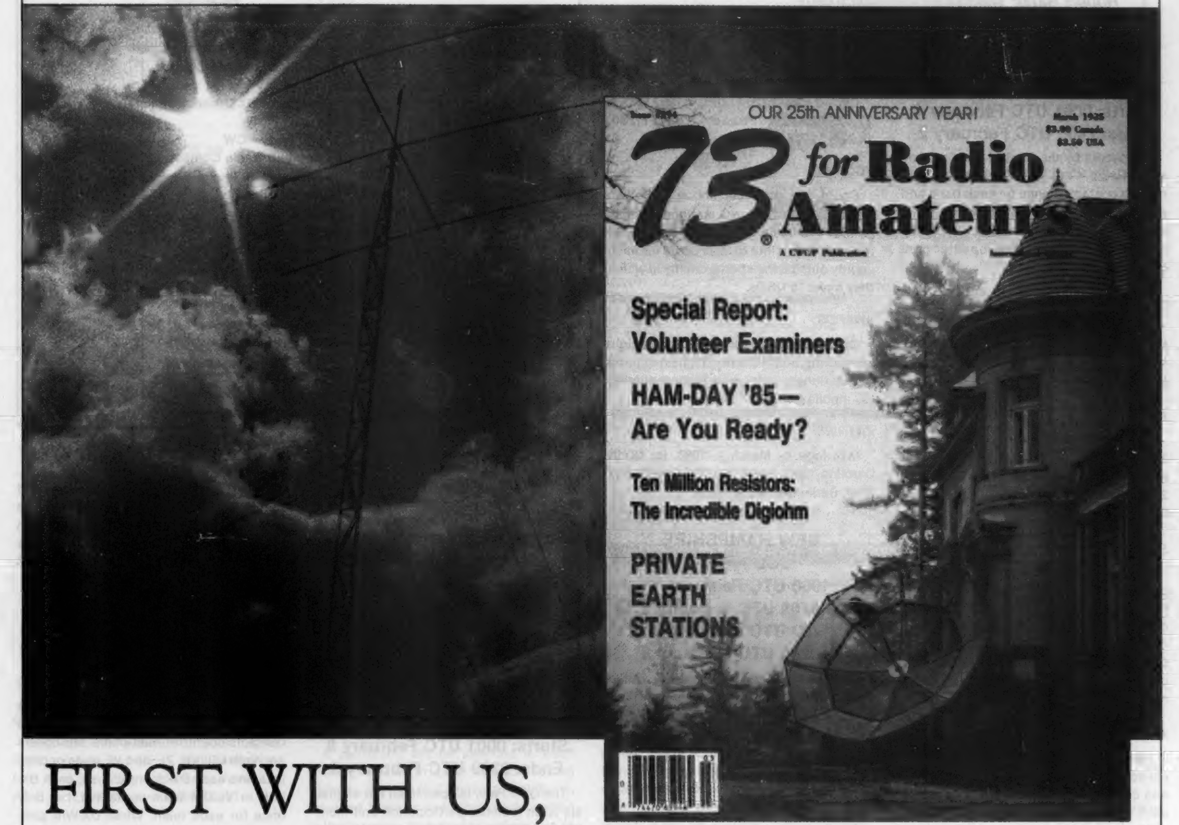

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CONTESTS

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

VERMONT QSO PARTY
Starts: 0001 UTC February 1
Ends: 2400 UTC February 2

Sponsored by the Central Vermont Amateur Radio Club (W1BD). Each station may be contacted once on each band and mode (CW, phone, RTTY). CW and RTTY contacts must be in the CW and RTTY subbands. Duplicate and repeater contacts are invalid.

EXCHANGE:

RS(T) and state, province, ARRL country, or two-letter designator for VT county (AD, BN, CA, CN, EX, FN, GI, LA, OG, OL, RU, WA, WM, WR).

FREQUENCIES:

Phone—3.910, 7.230, 14.260, 14.320, 21.360, 28.570, 50.110, 144.2. CW—3.540, 3.720, 7.040, 7.120, 14.040, 21.040, 21.140, 28.040. RTTY—3.620 and 90 kHz from lower edge of other RTTY subbands.

SCORING:

Score one point per phone contact, 5 points per CW or RTTY contact. VT stations multiply QSO points by sum of VT counties, states, Canadian provinces, and ARRL countries (exclude US/Canada). Others multiply QSO points by the number of VT counties (14 maximum). Add 20 bonus points for working W1BD.

AWARDS:

For non-VT stations, certificate to highest-scoring station in each state, province, and country. Certificates will be given to each VT station submitting a log. A plaque will go to the highest-scoring VT station. W/VT Award given to stations working 13 of Vermont's 14 counties.

ENTRIES:

Send SASE for official log and score sheets. Send logs/facsimiles, name, class of license, and address—not later than March 1, 1986, to: D. Loverin WA1PDN, 50 Liberty Street, Montpelier VT 05602. Include an SASE for a copy of the results.

NORTH CAROLINA QSO PARTY
Starts: 1400 UTC February 1
Ends: 0500 UTC February 2

The North Carolina QSO Party is sponsored by the Alamance ARC. Work stations once per band and mode (CW and phone). Work mobiles as they change counties.

EXCHANGE:

Signal report and ARRL section (county for NC stations).

FREQUENCIES:

CW—3.525, 3.725, 7.025, 7.125, 14.025, 21.025, 21.125. Phone—3.890, 7.290, 14.290, 21.275.

SCORING:

Count one point per phone QSO; two points per CW QSO. NC stations multiply by total NC counties worked. NC mobiles may add 500 points to their score for each county outside their home county in which they make 15 QSOs.

AWARDS:

Certificates will be awarded to the highest-scoring non-NC entry, highest-scoring NC stationary entry, and highest-scoring NC mobile entry.

ENTRIES:

Mail logs by March 1, 1986, to: North Carolina QSO Party, c/o K4EG, PO Box 3064, Burlington NC 27215.

NEW HAMPSHIRE QSO PARTY
1900 UTC February 1 to 0700 UTC February 2
1400 UTC February 2 to 0200 UTC February 3

Sponsored by the NH Amateur Radio Association. Stations may be worked once per band and mode. NH stations may work each other.

EXCHANGE:

Send RS(T) and ARRL section/country or NH county as appropriate.

FREQUENCIES:

Phone—1.875, 3.975, 7.235, 14.280, 21.380, 28.580, 50.115, 144.205. CW—1.810, 3.555, 7.055, 14.055, 21.055, 28.055. Novice—3.730, 7.130, 21.130, 28.130.

SCORING:

NH stations score 1 point per QSO, multiplied by the sum of NH counties, ARRL sections, and DXCC countries worked (excluding NH, US, Canada, and DXCC countries within ARRL sections). Others score 5 points per NH QSO times the number of NH counties worked (10 maximum). In addition, all stations count 20 bonus points each for working the following NHARA member club stations: N1BYQ, WB1CAG, WB1FFZ, KB1HJ, W1OC, K1RD, W1WQM, and K0UNJ for a maximum of 160 bonus points.

AWARDS:

Certificates to highest scorer with a minimum of 5 QSOs in each NH county, ARRL section, and DXCC country. Plaque to the highest scorer in NH courtesy of Concord Brasspounders. A Worked All NH Award, sponsored by W1JB, will go to participants who work all 10 NH counties.

ENTRIES:

Send your entry no later than March 25, 1986, to Mount Moriah Repeater Association, c/o Bud Valcourt N1BYQ, 19 Teague Drive, Salem NH 03079. Include a large SASE for a copy of the results.

YL-ISSB QSO PARTY—PHONE
Starts: 0001 UTC February 8
Ends: 2359 UTC February 9

The QSO Party is open to all but emphasis is on member participation and member-to-member contacts. Operating categories include: single operator, DX-W/K partners, and YL-OM teams. All US General phone bands will be used. VHF and UHF may be used but all contacts must be direct and not through repeaters. Nets are not allowed!

EXCHANGE:

Signal report, state/province or country, name, ISSB number (if member), and DX-W/K partner's call. If no partner, leave blank. If nonmember, send "no number."

FREQUENCIES:

On HF use the USA General-class band portions. On 20 meters be aware of the nets on 14.313, 14.336, etc. Stay away from 14.332; leave it open for DX members trying to make contacts. Check 80 and 40 meters on the hour. VHF and UHF use simplex only.

SCORING:

Score 3 points for each two-way member contact on own continent, 6 points if different continent. Nonmember contacts count *one* point. Only member-station contacts count for multipliers. Multipliers are each US, VK, ZL, and VE state or province and each DX country. Also, each DX-W/K or YL-OM team contacted, but only once for each team. When DX-W/K partners contact each other it counts as a double multiplier. If your total dc input power is 250 Watts or less during the entire QSO Party, then count an additional power multiplier of *two*. Final score is sum of QSO points times the total multiplier.

AWARDS:

Special certificates will be awarded to the overall winners of each category. Regular certificates for DX country, US state, and Canadian province winners.

RESULTS

WINNERS OF THE 1985 BERMUDA AMATEUR RADIO CONTEST

West Germany	DF9ZP	137,750
United Kingdom	G4BWB	276,070
United States	K2UR	137,020
Canada	VE1NG	117,480
Bermuda	VP9HK	1,314,135

CALENDAR

Feb 1–2	North Carolina QSO Party
Feb 1–2	Vermont QSO Party
Feb 1–3	New Hampshire QSO Party
Feb 8–9	Dutch PACC Contest
Feb 8–9	YL-ISSB QSO Party—Phone
Feb 15–16	ARRL International DX Contest—CW
Feb 22	RTTY World Championship Contest
Feb 22–23	Alabama QSO Party
Mar 1–2	ARRL International DX Contest—Phone
Mar 9–10	Wisconsin QSO Party
Mar 15–16	YL-ISSB QSO Party—CW
Mar 15–16	Bermuda Amateur Radio Contest
Apr 12–13	CARF Commonwealth Phone Contest
Apr 14	ARRL 144-MHz Sprint
Apr 22	ARRL 220-MHz Sprint
Apr 30	ARRL 432-MHz Sprint
May 8	ARRL 1296-MHz Sprint
May 17	ARRL 50-MHz Sprint
Jun 7–8	ARRL VHF QSO Party
Jun 28–29	ARRL Field Day
Jul 1	CARF Canada Day Contest
Jul 12–13	IARU Radiosport Championship
Aug 2–3	ARRL UHF Contest
Aug 16–17	New Jersey QSO Party
Sep 13–14	ARRL VHF QSO Party

ARA

SQUELCH TAIL

NEWSLETTER OF THE MONTH

February's award-winning publication is the Arizona Repeater Association's *Squelch Tail*, edited by Betty Kaiser WA6HRX. The *Tail* is mechanically one of the best newsletters we have seen in a long time. Of course, good looks aren't the only thing that the *Squelch Tail* has going for it! Betty and her staff fill its pages with interesting news clips and feature articles, drawing from sources such as *Westlink* and the *ARRL Letter*.

To enter your club's newsletter in *73*'s Newsletter of the Month Contest, send it to *73* Magazine, Editorial Offices, 80 Pine Street, Peterborough NH 03458, Attn: Newsletter of the Month.

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ENTRIES:

Logs must show usual contact info plus ISSB numbers and QTHs. Mail entries before April 30, 1986, to Bill Early WA9AEA, PO Box 401, McHenry IL 60050-0401.

DUTCH PACC CONTEST
Starts: 1200 UTC February 8
Ends: 1200 UTC February 9

Use all bands, 160 through 10 meters, CW and SSB. No crossmode operations are allowed and please use the band sections according to the IARU recommendations. Each station may be worked only once per band regardless of mode. Operating categories include single operator, multi-operator, and SWL.

EXCHANGE:

RS(T) plus sequential QSO serial number starting with 001. Dutch stations will send their two-letter province abbreviation instead of a QSO number: GR, FR, DR, OV, GD, UT, YP, NH, ZH, ZL, NB, and LB.

SCORING:

Each QSO with PA, PB, or PI counts one point. Multiply QSO points by the number of provinces worked on each band (6×12=72 maximum). SWLs count one point per Dutch station heard and multiply by provinces heard on each band (72 maximum).

ENTRIES:

As usual, a score calculation is required. Please use a multiplier column and insert multipliers only if they are new. A log must be signed for observation of the contest rules. SWL logs must contain code groups given by the Dutch station and the foreign station worked. Send logs not later than March 31, 1986, to: F. Th. Oosthoek PA0INA, PO Box 499, 4600 AL Bergen op Zoom, Netherlands.

A certificate will be awarded to each country winner in each category along with the second- and third-place stations, provided there is sufficient participation in that country. Certificates will also go to winners in each call district of JA, LU, PY, UA9/0, VE/VO, VK, W, ZL, and ZS.

ARRL INTERNATIONAL DX CONTEST
CW
Starts: 0000 UTC February 15
Ends: 2400 UTC February 16
Phone
Starts: 0000 UTC March 1
Ends: 2400 UTC March 2

The annual DX contest for all DX hunters is sponsored by the ARRL and open to all amateurs worldwide. W/VE amateurs are to work as many amateur stations in as many DXCC countries as possible on 1.8 to 30 MHz, excluding the 10-MHz band. Foreign amateurs are to work as many W/VE stations in as many states and provinces as possible. Check January, 1986, *QST* for any last-minute rule changes. Operating categories include:

(A) Single operator—one person performs all operating and logging functions. Spotter nets are not allowed and only one transmitted signal may be used at any given time. Within the single-operator category participants may compete within allband or single-band categories as well. Single-band entrants who make contacts on other bands should submit logs for checking purposes.

(B) Multi-operator—more than one person operates, checks for duplicates, logs, etc. Within this category entrants may compete within single-transmitter, two-transmitter, or unlimited-transmitter categories. Single transmitter implies only one transmitted signal at any given time and once station has begun operation on a given band, it must remain on that band for at least 10 minutes. Listening time counts as operating time. Multi-op single-transmitter stations must keep a single, chronological log for the entire contest period.

Two-transmitter multi-op entrants are limited to only two transmitted signals at any given time. Again, each station must stay on a given band for a minimum of 10 minutes. Both transmitters may work any and all stations; the second transmitter is not limited to only working new multipliers. Each of the transmitters must keep a separate log.

With an unlimited number of transmitters for multi-op entrants, only one transmitted signal per band is permitted at any given time. Separate, chronological logs must be kept for each band.

(C) QRP—10 Watts input or less (or 5 Watts output or less), single operator, allband only.

Each operator must observe the limitations of his license at all times. Your callsign must indicate your DXCC-country station location. One operator may not use more than one callsign from any given location during the contest period. The same station may be worked only once per band; no crossmode, crossband, or repeater contacts. Aeronautical- and maritime-mobile stations outside the US and Canada may not be worked for QSO or multiplier credits by W/VE stations. All transmitters and receivers must be located within a 500-meter-diameter circle, excluding directly connected antennas. This prohibits the use of remote receiving installations. However, multi-operator stations may use spotting nets for multiplier hunting only.

EXCHANGE:

W/VE stations send RS(T) and state or province. DX stations send RS(T) and power as three-digit number approximating transmitted input power.

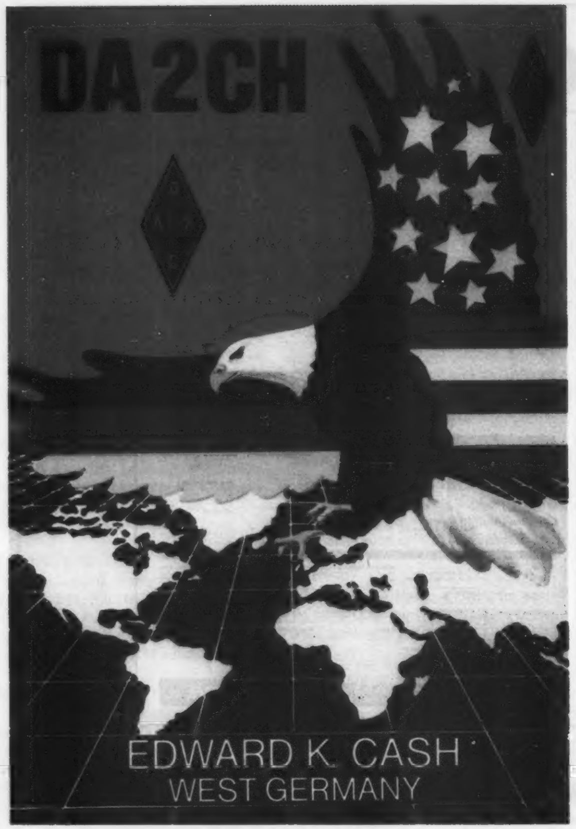
SCORING:

All stations count 3 points per valid QSO. W/VEs multiply QSO points by sum of DXCC countries (except US and Canada) worked per band. DX stations multiply QSO points by number of US states (except KH6/KL7) and District of Columbia (DC), VE1-7, VO, and VE8/VY1 worked per band (58 maximum per band).

AWARDS:

Plaques awarded to top W/VE scorer in each entry category, top scorer in the single-operator allband category worldwide and on each continent, worldwide leaders in the single-operator single-band, QRP, multi-op single-transmitter, multi-op two-transmitter, and multi-op unlimited categories, plus additional special plaques as sponsored.

Certificates will be awarded to top single-operator allband entries from each country and ARRL section; top single-band entries in each US call area and each country; top multi-op entries in each country, US call area, and in Canada. Additional single-band and multi-op certificates will be awarded if significant effort or competition is displayed. Also, DX entrants making more than 500 QSOs on either mode will receive certificates. ARRL-affiliated clubs also compete for gavels on three levels: unlimited, medium, and local clubs.



QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73*, 80 Pine Street, Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

ENTRIES:

All entrants are encouraged to use official forms available from the ARRL to report contest results. Logs must indicate times in UTC, bands, calls, and complete exchanges. Multipliers should be clearly marked in the log the first time worked. Entries with more than 500 QSOs total must include cross-check sheets (dupe sheets). All operators of multi-op stations must be listed.

Entries must be postmarked within 30 days of the last contest weekend, otherwise they will be classified as check logs: no extensions, no exceptions. All stations are requested to send their entries in as early as possible. Each entrant agrees to be bound by the provisions of the ARRL rules, licensing authority, etc., and the decisions of the ARRL Awards Committee are final. Usual ARRL disqualification rules apply. Address entries and forms requests to ARRL Headquarters, 225 Main Street, Newington CT 06111.

RTTY WORLD CHAMPIONSHIP
0000–2400 UTC February 22

Sponsored by *The RTTY Journal* and *73* Magazine. The same station may be worked once on each band. Crossmode contacts do not count. Single-operator stations may work 16 hours maximum, while multi-operator stations may operate the entire 24-hour period. Off times are no less than 30 minutes each and must be noted in your log(s).

Operator classes are (a) single operator, single transmitter, and (b) multi-operator, single transmitter. Entry categories are (a) single band, and (b) allband, 10–80 meters.

EXCHANGE:

Stations within the 48 continental US states and Canada must transmit RST, and state, province/territory. All others must transmit RST and consecutive contact number.

SCORING:

5 QSO points for contacts with W/VE stations located within the continental US and Canada. 10 QSO points for all other contacts. 1 multiplier point will be awarded for each of the 48 continental US states (a District of Columbia contact may be substituted for a state of Maryland multiplier), Canadian provinces/territories, and DX countries worked on each band (excluding US and Canada). Total QSO points times total multipliers equals claimed score.

AWARDS:

Contest awards will be issued in each entry category and operator class in each of the US call districts, Canadian provinces/territories, as well as in each DX country represented. Other awards may be issued at the discretion of the awards committee. A minimum of 25 QSOs must be worked to be eligible for awards.

ENTRIES:

Entries must include a separate log for each band, a dupe sheet, a summary sheet, a multiplier checklist, and a list of equipment used. Contestants are asked to send an SASE to the contest address for official forms. All entries must be postmarked no later than March 22, 1986, and sent to RTTY World Championship, c/o *The RTTY Journal*, 1155 Arden Drive, Encinitas CA 92024.

Operating in excess of legal power, manipulating scores or times, or failure to omit duplicate contacts which would reduce the overall score more than 2% are all grounds for immediate disqualification. Decisions of the contest committee are final.

ALABAMA QSO PARTY
Starts: 1600 UTC February 22
Ends: 2300 UTC February 23

Sponsored by the Birmingham Amateur Radio Club. Work stations once per band and mode. Work mobiles and portables again as they change counties.

EXCHANGE:

Signal report and QTH (county for Alabama stations; state, province, or country for others).

FREQUENCIES:

CW—1.810, 3.550, 7.050, 14.050, 21.050, 28.050. Phone—3.900, 7.260, 14.300, 21.360, 28.600, 50.110, 144.20, 146.52. Novice—10 kHz up from the low end.

SCORING:

Count 2 points per phone QSO, 3 points per CW QSO. Alabama stations multiply by total states, provinces, Alabama counties, and countries. All others multiply by total Alabama counties (67 maximum). Multiply scores by 1.5 for 200 Watts or less and multiply by 1.5 for noncommercial power (mobiles excluded from noncommercial multiplier). Mobiles add 500 bonus points for each county from which 10 or more QSOs are made.

AWARDS:

Trophies will be awarded to the top out-of-state station, top Alabama fixed/portable station, and the top Alabama mobile station. Certificates will be awarded to the top scorer from each state, province, country, and Alabama county. Certificates will also be issued for top Novice and Technician scores in and out of Alabama.

ENTRIES:

Mail entries by March 15, 1986, to Bill Levey WA4FAT, 3629 Dabney Drive, Birmingham AL 35243. Include an SASE for results.

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73 INTERNATIONAL

Each month, 73 brings you ham-radio news from around the world. In this collection of reports from our foreign correspondents, we present the latest news in DX, contests, and events, as well as keep you abreast of the technical achievements of hams in other countries.

If you would like to contribute to your country's column, write to your country's correspondent or to 73 Magazine, Pine Street, Peterborough NH 03458, USA, Attn: International Editor.

AUSTRALIA

J. E. Joyce VK3YJ
44 Wren Street
Altona 3018
Victoria
Australia

Following the short report in an earlier column about the 150-year celebrations in VK5, a letter sent to me by Mr. Graham Horlin-Smith VK5AQZ should be of interest, I feel, to any group planning a similar event. Graham is a controller of the South Australian 150-year celebrations, and the following is his report:

THE VK5 150-YEAR REPORT

Eighteen months of planning to link amateur radio with S.A.'s 150th birthday in 1986 reached fruition on Monday, May 27, 1985, when VK5JSA, the special-events callsign, was activated from the center of the city of Adelaide. The location was the Renaissance Center which overlooks the Rundle Mall.

Three operating points were established. At street level, a group of HF operators worked two rigs from an OB radio van, a Kenwood 930 and a Yaesu 757GX out of a 204 BA, 4-element monobander and a 40/80-meter trapped dipole, respectively, located on the roof of the seven-story building about 200′ above ground level.

The second operation for CW and RTTY was located in Radio Rental's (Adelaide) ground-floor shop window (5-band trapped vertical also at 200′), and the third consisted of UHF/VHF, ATV, and a satellite display on the 6th floor (the restaurant), which had a commanding view of Adelaide and Repeaters 5 and 8 in the Adelaide Hills.

Computers by ICL demonstrating the link with amateur radio and substantial visual displays by the WIA S.A. Division, International Communications Services, Dick Smith's (Adelaide), the Department of Tourism, and the Jubilee-150 Committee complemented all operating points. Outside scenic lifts open into the restaurant, and an average of 2,000 visitors daily had direct eyeball contact with amateur radio during the week's operation.

The activity launched a program which will continue throughout 1986. As a result of this and other planned activities, VK5 amateurs expect to propagate 100,000 special Jubilee Souvenir QSL cards worldwide and 2,000 awards during 1986. The special issue welcomes amateur participation in S.A.'s 2,000 plus planned Jubilee programs and extends "Happy Birthday" greetings to S.A. in eight different languages. The first Grand Prix to be held in Australia will coincide with the commencement of a year of birthday parties. December 28th was S.A.'s Proclamation Day, and 1986 is its 150th birthday or sesquicentennial year. Come on over and enjoy S.A.!

S.A. has chosen to share and twin its 150th-year celebrations with Texas (Adelaide and Austin, Texas, being linked as twin cities). In excess of 170 towns and districts and 300 schools have been distinctively linked and exchanges have already commenced. S.A. amateurs see a role in providing the communications link to assist, where possible, with towns, schools, activity groups, and community and service organizations—a daunting task, but looked upon as a real challenge with a spirit of adventure which hopefully will be rewarding insofar as the hobby of amateur radio is concerned. Promotional-type activities and working with Jubilee activities, it is hoped, will provide a positive exposure of the hobby as well as an awareness and a better understanding of amateur activities in the long term.

"Amateur Radio Week, Promoting S.A." fired the first shot and launched the program. The official launch was by Dr. Ian McPhail, Chairman of the Bi-State Centenary Committee, in the VIP area of the Renaissance Center Restaurant on the 6th floor. Escorted tours, press releases, and media involvement in amplified amateur-radio links with Texas via San Francisco into the Mall focused the public's attention on amateur radio. Later, special appearances by Mr. Gavin Keneally, the Hon. Minister of Tourism and Local Government, and a special amateur link between Adelaide's Lord Mayor, Mr. Jim Jarvis, and Austin's Mayor Frank Cooksie were scheduled.

The WIA Committee of Jenny Warrington VK5ANW, Rowland Bruce VK5OU, and VK5AQZ acknowledged the financial sponsorship of the S.A. Department of Tourism, Estrow (Civil Engineers and Supervisory Consultants), Radio Rentals, International Communication Services, Dick Smith's, The Electric Bug, Captain Flash Advertising, Norman's Estates Winery, ICL, the South Coast ARC, the Renaissance Center Management (Emanual Group), Sound Out Services, the Renaissance Tower Restaurant Management, and the many amateurs themselves who contributed time and effort.

STICKY TAPE AND STRING

The problems of erecting temporary HF antennas on the roof of a city building were many. The most important consideration was to ensure safety for both the crew erecting the antennas and the general public below. Members of the antenna crew were no real worry, because one look over the side of an eight-story building is all it takes for self-preservation to take over; any thoughts of daring deeds vanish instantly.

The safety of the public is another matter. We had to erect an efficient antenna system that would stay put for the duration of the project, not fall off the building and cause injury below, not to mention rearranging the vswr and element spacing of the antenna.

The antennas we decided on were a 204 BA, 4-element, 20-meter monoband yagi, which was kindly made available to us by a gentleman from the near country, a half-wave dipole on 80 meters with traps for 40 meters, a couple of trapped verticals, and a VHF Slim Jim.

The installation of all these antennas took one and a half days working at a moderate pace, and although the roof now resembled an elaborate bird trap, antenna performance was interesting if not predictable.

The 204 BA exhibited a vswr of 1.1:1 right across the band. I suspect that the 300 meters of RG-8 might have been responsible for making it look slightly better than it was. The dipole, also fed with 300 meters of RG-8, underwent apparent vswr changes, as originally it was tuned using a short feeder. However, the result was still reasonable and well within the scope of the automatic AT units used. These antennas enabled the station to transmit strong signals, and generally we received very good reports.

Due to a high noise level, reception was not as good as we had hoped. The noise problem was the result of a trade-off between going for the efficiency of elevation and the local noise generated in the elevator control rooms. The trapped verticals, needless to say, were particularly susceptible to the noise, and as a result they weren't very successful.

Surprisingly, the Slim Jim performed well in spite of the fact that it also was fed with 300 meters of RG-8.

When the antenna crew assembled to disassemble the installation, one gentleman (as usual) was heard to suggest cutting the guy ropes and running. When handed a sharp knife and told that we would wait under several feet of concrete, he retracted his suggestion, we reverted to the original plan, and the antennas were lowered safely in about two hours.

NEW TOWER LEGISLATION IN VK3

New planning controls have been introduced in the Metropolitan area of Melbourne. After a long battle by the WIA, with many submissions to the planning authorities on behalf of all amateurs, it seems we have again gotten the short end of the stick. It also appears that no matter what we do in the way of community service, we amateurs are still a minority voice, as you will note by the regulations.

TV viewers can have antennas on thin towers as high as they like; CB operators can have their 4- or 5-element yagis up in the air with virtually no control, but we amateurs are governed down by the regulations if we want beam antennas on 15, 20, or 40 meters. Part of the new regulations follow:

A Radio Mast is a mast which, together with antenna:

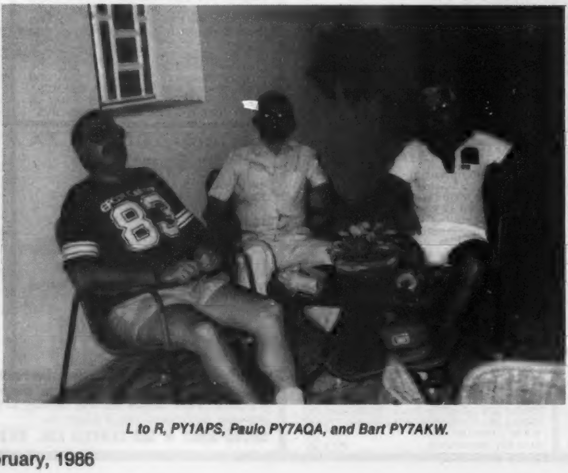
(1) exceeds a height of 14 meters above ground,

(2) when attached to a building exceeds a height of 5 meters above the roof line,

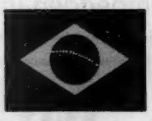
(3) has any horizontal distance in excess of 6 meters, or

(4) has a structure, not including the antenna, exceeding 50 centimeters in width at any point in excess of 3 meters above ground level.

With the attitude of some of our local councils, any new amateurs, without prior council approval, will have little hope of getting even a 15-meter dipole up into the air, let alone a TH6DXX at a reasonable height.



L to R, PY1APS, Paulo PY7AQA, and Bart PY7AKW.



BRAZIL

Gerson Rissin PY1APS
PO Box 12178 Copacabana
20000 Rio de Janeiro, RJ
Brazil

PAULO SIMPLICIO PY7AQA

As I have written before, sometimes I have to travel due to my job. During these trips when I have free time, I like to visit friends, most of them known for more than twenty years through our contacts on radio.

On my last trip to Recife (State of Pernambuco), I asked Bart PY7AKW (ex PY0CQ and PY0DX on St. Peter & Paul Rocks) to go with me to Timbauba, a very small city with many shoe factories. As you surely know, Brazil is the greatest exporter of shoes to the United States and you may be putting on a pair made in Timbauba.

In that city I was anxious to visit Paulo Simplicio PY7AQA, who is the first licensed amateur there. He is a very well known person by everybody. We didn't have his address, but it was not difficult to reach his house. We just asked people and they showed us the direction. The house was located on a very narrow street near the main square.

The last time I met Paulo personally was about eighteen years ago. On the bands he had an unmistakable voice—very grave and sounding like a thunderstorm.

Unfortunately, he lost that beautiful voice, so we will never hear it again. He got sick with cancer, and the doctors removed the upper part of the trachea containing the vocal cords.

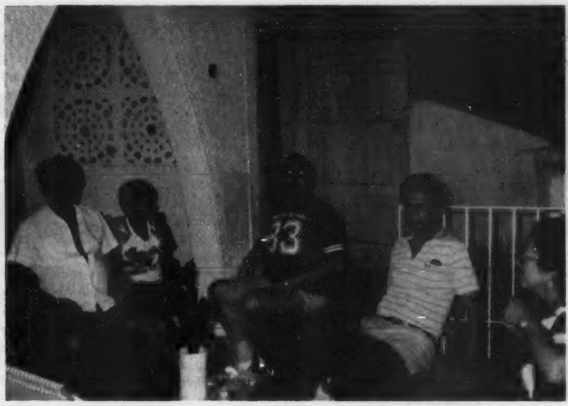
He told us that after this serious sickness he thought that he would not have more than a few months of life, so he refused to learn how to speak again. After the first lesson, he gave up, disappointed.

In this way he lived for a few months. One early morning, he got up suddenly and told himself, "I am a man; I am not a cat!" At that moment he tried to work out how he could pronounce a syllable.

Day after day Paulo did the same. Nobody at home, even his wife, knew about his decision. A few months later he was able to speak again, and when his wife came to the breakfast table one day, he said, "Good morning—how are you?" Tears were a sign of their happiness.

Paulo himself wanted to tell the good news to his doctor, to surprise him also. . .and he did. In spite of many years in his profession, the doctor could not believe what he was hearing. Paulo PY7AQA was such a perfectionist that he had developed his own method, and he was talking almost as a normal person.

On our way home we stopped in Olinda and visited Firmino PY7SJ and Ivanildo PY7MM. We had oysters and beer and reflected upon the excellent day we'd had.



L to R, Firmino PY7SJ, PY1APS, and Ivanildo PY7MM.

INDIA

James Kalassery VU2ARL
49 Giri Nagar
Cochin 682 020
India

AMATEUR SERVICE RULES REVISED

The Wireless Planning and Coordination (WPC) Wing of the Ministry of Communications of the Government of India, by a notification dated October 4, 1985, has revised the Indian Wireless Telegraph (Amateur Service) Rules, 1978, to include more bands and operating privileges for different classes of radio amateurs in India.

A little while ago, when the Restricted Class License—the then no-code license—was introduced, the holders were authorized operation only on the 144-146-MHz band. With this revision, they are authorized both 144-146 MHz and 434-438 MHz on A3E, H3E, J3E, R3E, and F3E modes. Only terrestrial operation is permitted for which the maximum power usable is 10 Watts.

For holders of the Grade II license (the next higher class), the frequency and power authorized on V/UHF is the same. However, they are permitted to operate on A1A, A2A, F1B, and F2A modes also. The major changes for this category of license are in operational parameters—they are now allowed A1A, A3E, H3E, J3E, and R3E modes—on HF bands. However, authorization to work on voice modes is subject to the submission of proof of having made at least 100 contacts with other amateurs on CW. The new bands added on HF are 1820-1860 kHz and 3500-3700 kHz.

Grade I license holders, in addition to the modes permitted for the Grade II license holders, have A2A, F1B, F2B, F3E, F3C, A3C, and A3F modes on HF, VHF, and UHF. The maximum input power continues to be 150 Watts on HF and 25 Watts on V/UHF terrestrial. Additional bands given are 1260-1300 MHz, 3300-3400 MHz, and 5725-5840 MHz. Amateur satellite operation is also permitted in the appropriate subbands with a maximum output (eirp) of 30 dBW.

The holders of the Advanced Class license, the highest category possible for a radio amateur in India, are entitled to all the privileges of a Grade I license and are authorized to use up to 400 Watts dc input in the following subbands: 3520-3540 kHz, 3890-3900 kHz, 7050-7100 kHz, 14050-14150 kHz, 14220-14320 kHz, and 21100-21400 kHz. On VHF, the maximum dc input is 50 Watts for terrestrial operation.

In general, radio amateurs in India have almost all the frequency allocations possible in Region III, the best being the 1820-1860-kHz and 3500-3700-kHz allocations. This is especially true at this time, when the MUF goes down considerably as night sets in. And for the research-minded experimenters, the bands above UHF also are available. The allocation of 1820-1860 kHz is on the primary shared basis: 18068-18168 kHz on non-interference and the non-protection basis, and 1260-1270 MHz for Earth to space, Satellite Service only. We hope that these new authorizations of emissions and frequencies will boost up amateur activity in India considerably.

de VU2ARL

Miss R. Subha
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India

INDIA CATCHES UP

One of the main demands of the Federation of Amateur Radio Societies of India, in their discussions with the Communications Ministry of the Government of India, was that all international allocations to the amateur service should be available to Indian amateurs.

After some foot-dragging and half-hearted releases of some band segments during the past two years, WPC (the Wireless Planning and Coordination Wing—India's FCC) has now gone the whole hog and announced a complete revision of the earlier allocations. The new announcement opens up all the HF, VHF, UHF, and microwave amateur bands to Indian amateurs, with the notable exception of the 6-meter band.

This relaxation is generally in line with the liberalization in all spheres—particularly radio communications (more on that in a later column). In a strange anomaly, 2-meter hand-helds still cannot be used in the mobile mode without a special 90-day authorization involving a US$0.80 fee and interminable waiting! In the generally liberal atmosphere, however, everbody ignores this requirement and nobody has ever been cited for breach of the law!

de R. Subha

ISRAEL

Ron Gang 4Z4MK
Kibbutz Urim
Negev Mobile Post Office 85530
Israel

THE MEXICAN EARTHQUAKE

It would seem that with the huge distance separating Israel and Mexico, the earthquake disaster would have had very little repercussion here. However, as it turns out, with Israel's rich ethnic mosaic, there are many thousand Israelis with relatives in that stricken land. What ensued was one of the largest, if not the largest, public-service operation in the history of Israeli amateur radio.

When news of the disaster was given by the local media, it was stated that since all normal channels of communications out of Mexico had been disrupted, the only means of relaying messages was via radio amateurs. Almost immediately, hams all over Israel began to receive phone calls from people concerned about the fate of their dear ones in the disaster area.

One of the first contacts was made between David Ben Bassat 4X4WH (see photo) and Shimon Kushnir XE1GGU. The amateurs around the country organized themselves, with amateurs in each city receiving phone calls from those concerned, collating them, and having the messages handled by those in contact with Mexico. The radio and TV gave out the phone numbers of the key amateurs in each area, and for a week the phones were ringing almost nonstop at their homes.

With the ionosphere being quite fickle at this time of the sunspot cycle, especially over such a long haul as between Israel and Mexico, stations in between helped out with the relays—such as Mel G4WMP and two Washington area hams, David K3STM and Jim K3JW, who put in overtime. Later on, about a week after the first quake, the Ministry of Communications eased the strain on the ionosphere by putting in a free telex line to K3JW from Israel.

As well, early on in the operation, a list of the areas of Mexico City that were struck or were OK was circulated among the amateurs so that in many cases they could put callers immediately at ease. The "mailbox" in the Haifa RTTY repeater was pressed into service, carrying a lot of the message load, and proved to be quite instrumental in easing pressures.

When the operation wound down, about a week and a half after the earthquake, thousands of telephone calls had been processed. Quite a few amateurs had literally worked themselves to exhaustion, and a few score had been involved in this public service. Amateur radio had received, once again, so soon after 4Z4ZB's contact with the space shuttle, great publicity, with pictures of 4X4WH and his station and antennas having appeared on the national TV news.

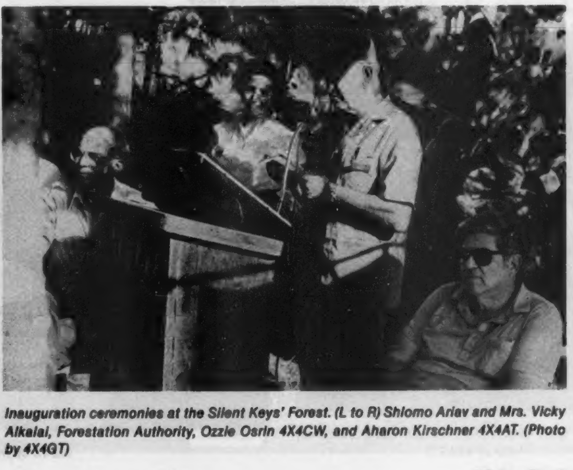
I have really not even begun to name the amateurs here who worked hard in this endeavor, as they are many, and I would doubtlessly risk overlooking a few. Hats off to them all!

THE SILENT KEYS' FOREST

One of the most popular ways that we in Israel remember those who have passed on is the planting of trees, a living memorial to them. With this custom in mind, Ozzie 4X4CW, the chairman of the Israel chapter of the Quarter Century Wireless Association and Israel's first licensed ham, conceived the idea of a grove to commemorate our Silent Keys.

After negotiations with the Keren Kayemet (JNF), the Israel Reforestation Authority, and a drive amongst hams and the families of the Silent Keys, enough money was raised for the planting of the grove, and daily contributions continue to come in for more trees.

On October 22nd, the Silent Keys' Forest was officially inaugurated with a ceremony at its site in the Ben Shemen forests in the hills overlooking the coastal plain near the Ben Gurion airport. The view there is quite spectacular, and it is indeed an ideal spot for Field Days that no doubt will be held there in the future.



Inauguration ceremonies at the Silent Keys' Forest. (L to R) Shlomo Ariav and Mrs. Vicky Alkalai, Forestation Authority, Ozzie Osrin 4X4CW, and Aharon Kirschner 4X4AT. (Photo by 4X4GT)

Ozzie 4X4CW (left) watches General Mordechai Bar Dagan and Prof. Amnon Rubenstein shake hands at the Silent Keys' Forest ceremony. David Ben Bassat 4X4WH is behind, and Froike 4X4AF is on the right. (Photo by 4X4GT)

At the ceremony, many VIPs were present, including the Honorable Professor Amnon Rubenstein, Minister of Communications, Leland Smith W5KL, president of the QCWA who had come in from an archaeological trip in Egypt for the occasion, the chief officer of the Israel Defence Forces Signal Corps (General Mordechai Bar Dagan), the head of the Keren Kayemet Reforestation branch, and, of course, the Israel Amateur Radio Club officers and those responsible for seeing the project through. The event was attended by over two hundred amateurs, their families, and families of the Silent Keys.

Speaking at the podium, the Minister of Communications praised the hams for their strong record of voluntary public service and said that in the expected era of peace, radio amateurs will play a vital role, helping to build bridges between us and our neighbors, replacing hostility with friendship.

The ceremony closed with the planting of saplings by the families of the Silent Keys and the VIPs. Although the forest is really only in its infancy, with about 2000 trees donated, already picnic tables and benches are there, and it will be a place close to the hearts of all the radio amateurs in Israel.

THE TEL-AVIV-JAFFA AWARD

A new award has been made available to licensed amateurs and SWLs called the Tel-Aviv-Jaffa Award. Issued by the city of Tel-Aviv-Jaffa, it is in color, bears a picture of the city's boardwalk, and is signed personally by the mayor.

A minimum of ten points is required, Tel-Aviv stations counting for one point, Jaffa stations for five, and if you were fortunate enough to have worked 4X75TA when it was in operation last year during the 75th anniversary of the founding of Tel-Aviv, then you receive ten points for that contact. Only contacts made after January 1, 1984, count.

Do not send QSLs but rather a list containing the details of all the contacts; the list should be signed by two other licensed amateurs. The fee is either $3.00, 8 D.M., or 2 pounds sterling, and all the above should be sent to the award manager: Shlomo Mussali 4X6LM, PO Box 8225, Tel-Aviv 61081, Israel.

YAWN

In these days of rapid developments in technology, yesterday's achievements are taken for granted—commonplace. Such was the case on Saturday, November 2nd, when one excited ham phoned the hot line of a popular radio station to be the first to report on 4X4AS, 4X4GI, and 4Z4ZT making direct two-way contact on FM with DJ0SL on the orbiting Spacelab during orbit 41. (On all other orbits, DJ0SL only made recordings of calling stations.)

The voice at the other end of the telephone answered, "So what?"

After the huge publicity received by 4Z4ZB's contact with W0ORE on a previous flight of the shuttle, apparently this is no longer news. Incidentally, this was 4Z4ZT's first satellite QSO, using only a 5/8-wavelength whip, and, in his excitement, leaving his set in the 5-Watt position!

ITALY

Mario Ambrosi I2MQP
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21029 Milano
Italy

We had the opportunity some months ago to introduce you to I0FCG—Francesco Cossiga, the President of the Italian Senate. The most important information to report to you now is that he has been elected President of the Italian Republic.

HV2VO and KD7RQ with I2SM.

He has received close to 90% of all the votes of the Parliament and the Senate and surely the support of 100% of the Italian hams.

The press has not reported correctly his ham activity, having some confusion with CB, but our hobby has received a lot of free "advertising" in all newspapers.

A few minutes on the first channel of the national television have been devoted also to Andrea I8WY—who at the end of July contacted the space shuttle on two meters. A simulated contact with the recording of the QSO has been shown during the main news broadcast.

The RadioRivista, the magazine of the Italian League, is devoting more space to microcomputers. From a survey it appears that locally the average amateur is 37 years old, is interested in computers, has tried at some time to build something himself (mainly antennas), and is interested in awards (37% have obtained the local awards while 31% are in some way interested in the DXCC).

Our average ham is reading 2.75 magazines devoted to radio or computers per month and spends $600 per year for rigs. He is mainly using SSB (92%), some CW (42%), and FM (66%). He likes to exchange QSL cards via bureau (82%) and direct (73%), even if this second method does not work too well.

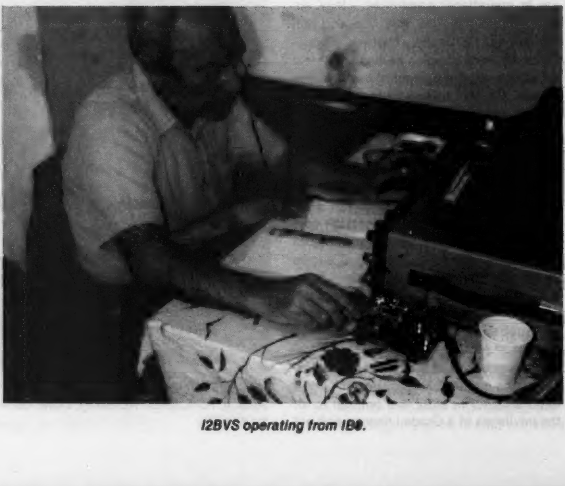
This first survey will be followed shortly by a second one on a broader basis, and it will be very useful to give to the League some indications on the policies to follow in the near future.

A new contest group has started operating from the Milano area. It consists of three hams, Giorgio I2VXJ, the ARI Contest Manager, Paolo I2UIY, the Secretary of the ARI DX Club, and Mario I2MQP, the

The Knights of the Laid Table.

ISRAEL AMATEUR

Leland Smith W5KL, QCWA world president (right), Helen Smith WA5WAR, and Shimshon Lotan 4X4GF at the Silent Keys' Forest ceremony. (Photo by 4X4GT)



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These are solid state, fully regulated 13.8 vdc power supplies. Both feature 100% solid state construction, fuse protection, and L.E.D. power indicator. U.L. listed.

2 amp constant, 4 amp surge $18.00 each

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Designed to provide a steady ± 5 vdc @ 240 ma. from a battery supply of 3.5 to 6.25 volts.
2 1/16" x 1 1/16 x 1 11/16"
$1.50 each

SLIM LINE COOLING FAN

Etri S# 99XM182 low noise fan. Measures 3⅛" square x 1" deep.
21 cfm, 23 db, 1700 rpm.
SPECIAL PRICE . . . $12.50 each

8" P.A. SPEAKER

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8 ohms coil
3.0 oz. ferrite magnet
Typical response range:
100 – 10,000 hz.
Power rating 15 watts max.
Drilled to mount line matching transformers.

$5.00 each

CASE OF 8 SPEAKERS $32.00

LINE CORDS

TWO WIRE

6' 18/2 SPT-1 flat	3 for $1.00
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6' 16/2 SJT round	$1.25 each

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8' 18/3 round	$2.00 each
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P.C. style non-threaded bushing
75¢ each
10 for $7.00

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$1.00 each
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HF and DX Manager. The group has been called "The Knights of the Laid Table" and intends to participate in all the main contests. One problem during the first operation was that no one agreed to operate while the others were eating—he was afraid to find nothing left for him.

If you look at the photo you will understand. I2UIY and I2VXJ are with guest operator Jimmy WA2JNN during the WPX CW. It was one of several pizza breaks, and from the pizza size you can understand it was not a short one. It can jeopardize results, but it does not matter. Food, wine, and *dames* are our main interest; radio is only second.

IK2DVG, I2CZQ, and I0GPY operated from HV2VO. Many contacts have been made on the low bands from the Vatican, thanks to a special antenna, a vertical wire 80 meters high, erected with a small aerostat. It has performed very well on 80 and 160 meters and will be used again in the future.

Another photo shows HV2VO with KD7RQ and I2SM.

Max I2DMK

Let's give a look to what has been done by I2DMK during his 26th and 27th expeditions. The first was from June 4 to 12 with Max I2DMK and Enzo I2BVS to IB0, Ventotene Island, IOTA EU 45. The island is in the Tyrrhenian Sea, 15 miles from the coast. It is 2 miles long and less than 1 mile wide. It was used for a prison during the Roman Empire and during the last war. A GP for 40 and 80 meters was installed together with a 2-element beam for 10, 15, and 20 meters. 4500 QSOs were made, 60% CW and 40% phone. On June 8, the island of Santo Stefano was activated on all bands with 400 contacts. The station was installed in a sentry post of the old penitentiary.

August was the month of the expedition of Max I2DMK to Stromboli, IOTA EU 17, with the usual callsign of I2DMK/ID9. Operations were on all HF and VHF bands, both CW and SSB.

Stromboli Island has a surface area of 5 square miles, and it has the only volcano in Europe where perennial eruptions come from its three mouths, shooting incandescent masses and burning lapilli towards the sky.

For both operations, QSL via I2MQP.

NEW ZEALAND

D. J. (Des) Chapman ZL2VR
459 Kennedy Road
Napier
New Zealand

IARU CONFERENCE, 1985

1985 was the Diamond Jubilee of IARU, and New Zealand was honored to be the host country for the Region III Conference—the 60th anniversary of the founding of the International Amateur Radio Union. It was held in Auckland.

The IARU is the link between over 2 million radio amateurs in 122 countries and the International Telecommunications Union, of which the Amateur Service and the Amateur Satellite Service are part. Formed in 1925, the IARU has observer status at all ITU conferences. It is controlled by an administrative council drawn from its three regions and an International Secretariat provided by the American Radio Relay League. The Regions of IARU are Region I, Europe, Africa, and the USSR; Region II, the Americas, and Region III, the rest of the world.

NZART is a founding member of the Region III association and plays a leading role in its activities. Each IARU Region holds a triennial conference so that there is a regional conference each year.

As NZART was the host society, I will report on the event in my next column.

RAOUL ISLAND

Chris Hannagan ZL8OY/ZM8OY will be operating from Raoul Island (Kermadecs) through September, 1986, while on a tour of duty at the weather station on the island. Chris will be operating mostly in the evenings (about 0600Z onwards) on the usual DX slots of the various frequencies, both phone and CW. He does NOT operate nets or lists. He will be using an ICOM 701 and a home-brew linear on the HF bands and an ICOM 560 for six meters.

Antennas will be delta loops for 80 and 40 meters, a three-element TET yagi for 20/15/10 meters (if the parts arrive in time), a vertical for 160 meters, and a five-element yagi on 6 meters.

Chris looks forward to many QSOs while on Raoul—many DX operators will have worked him when he was on Chatham Islands recently, and may also have worked him from the Auckland Islands—all QTHs Chris has been to on tours of duty with the weather service. QSLs to ZL4OY (Chris Hannagan, The Terrace, Warrington, Dunedin, New Zealand) or the QSL Bureau will be handled during his absence by his XYL.

WARNING

Recently an amateur received a warning letter because his station was not being operated in a manner in keeping with the spirit of amateur radio and the regulations. He had been monitored by the official monitoring station, which observed the following: The station tried to break into a conversation between two other overseas stations by repeating just the first two phonetics of his station callsign over and over. He repeated this continuously for 20 minutes before he was finally acknowledged. Only then did he give his FULL callsign.

How often do we hear this on the DX bands? Harmless enough, some might say, but it is in conflict with regulations because it creates "harmful interference," infringes on the proper use of the callsign, and is way out of line with the Amateurs Code. Think how other amateurs hearing outbursts of this type would judge fellow amateurs in the offender's country. Consideration for others is a virtue not practiced as well today as it used to be in my early days of ham radio.

Tom Phipps KA4CSG, Ft. Hood, Texas, left, with CT4UE.

POLAND

Jerzy Szymczak
78-200 Bialogard
Buczka 2/3
Poland

The IX National Congress of PRAA, which took place in Warsaw, adopted a program of activity including work on crucial problems of development of the Association. The Congress recommended that PRAA reconsider the organizational structure of the Association and even to liquidate non-active, small District Boards. The Congress also recommended restricting the number of domestic competitions and certificates.

The PRAA planned to obtain permission to work with portable and mobile devices, with a second QTH, and on new bands for its members. The Association would work for cancellation of the order of the Ministry of Communication allowing possible refusals to issue or the cancellation of a ham license without giving the reasons. The Headquarters of PRAA hoped to publish a register of Polish amateur-radio stations and bring it up to date.

The PRAA will collaborate with other institutions to work out national standards for technical parameters of electronic devices relative to their electromagnetic compatibility.

The following were selected to PRAA: Jerzy Rutkowski SP5JR, President; Wiktor Chojnacki SP5QU, Stanislaw Maciejkiewicz SP2JS, and Pawel Kaniut SP9RG, Vice Presidents; Secretary General—Jerzy Miskiewicz SP8TK; Treasurer—Zbigniew Klossowski SP4BQW; SW Manager—Jacek Rutyna SP9AKD; UHF Manager—Zbigniew Malik SP6AZT; ARS Manager—Jerzy Klabon SP3FFN, and Member in charge of propaganda and youth—Jan Ladno SP5XM.

I will write later on what the PRAA work accomplishes.

In April, 1985, a respected member of PRAA, Wiktor Chojnacki SP5QU, died. His writings informed readers of *Polish Ham* magazine about current events in the radio-amateur movement. Editor-in-chief of the *Bulletin* of PRAA, he prepared his twenty-fifth jubilee issue. SP5QU won the second prize of "Master of Technology" for collaboration on the production of a radiotelephone, "Klimek," for needs of the mountain rescues. The Polish radio-amateur movement has lost a strong friend.

The first Conference of the Polish Radio-Videography Club took place in Toruń in May. Present were 104 delegates from Poland and the foreign visitor, Y23NE. A sports commission verified QSLs and granted the first licenses for the full members, SP2JPG, SP3CMX, and SP3LRS. Lectures were delivered on club activities by SP2JPG, SP2DDV, SP3CAI, SP3CMX, SP3LRS, SP3GAX, SP6GTN, SP6NVA, SP7CHY, SP8JMW, SP9BWJ, and Tomasz Ilkow.

Many participants demonstrated their home-brew items and others brought factory-made devices. The resolution committee prepared a comprehensive report for PRAA authorities.

Polish hams took part in international contests in the last three months of 1985 involving Oceania, Spain, Portugal, America, Australia, and Canada.

PORTUGAL

Luis Miguel de Sousa CT4UE
PO Box 32
S. Joao do Estoril 2765
Portugal

SATELLITE TV IS HERE

According to the Mayor of Lagos, a parabolic dish will be installed in Valverde for the reception of satellite TV signals from several TV networks. Talks with the Secretary of State for Communications have started to find out the best place for construction of the receiving station.

The project is part of an official program which will include installation of several other dishes, one in Santarem and two in Lisbon. The priority project will be the one located in Valverde due to the big concentration of visitors in that particular area to the several well-known holiday resorts.

But this isn't all. Similar equipment, on a reduced scale, was built and installed by a small group of CT operators where French and German hams also were involved. With this simple but effective homemade TVRO, they've had good results. Signals from several European TV networks were seen without too much trouble (HI).

WORLD TELECOMMUNICATIONS DAY

This year, the events for this celebration took place in Oporto. The Associacao Portuguesa Para O Desenvolvimento das Telecomunicacoes (Portuguese Association for the Development of Communications) put together an interesting schedule with other state departments in this field. They were to let people know a little more about the wireless world; they were appreciated by students, technicians, engineers, etc.

FIRST CONGRESS OF TELECOMMUNICATIONS

If everything goes on schedule, this important meeting will be held this month (February, 1986). It will be devoted to developments and changes. Foreign representatives are expected. Forum Picoas in Lisbon (opened recently) has all the facilities needed for such meetings, so the Congress will be there.

VISITORS IN LISBON

Once again, we've had a visitor here in the shack, Tom Phipps KA4CSG, from Texas (I'm sorry, Tom! We don't have any rodeos in this country) was here and we had a nice chat. Many thanks, and keep crossing the Atlantic. You are always welcome.

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PROPAGATION

Jim Gray W1XU
73 Staff

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA							20	20				
ARGENTINA	20	40	40	40	80	80				20	15	15
AUSTRALIA	20		20		40	40	20	20			15^{1}	15^{1}
CANAL ZONE	15	20	20	40	40		20	20	15	15	15*	15*
ENGLAND	20	40	80	40	40		20	20	20	20	20	20
HAWAII	20		20		40	40	80	20			15^{1}	15^{1}
INDIA	$20/40^{1}$					20^{1}	40^{1}	20^{1}				15^{1}
JAPAN	20						20	20				20
MEXICO	15	20	20	40	40		20	20	15	15	15*	15*
PHILIPPINES							20					
PUERTO RICO	15	20	20	40	40		20	20	15	15	15*	15*
SOUTH AFRICA			40^{1}	40^{1}				15	15	15	20	20
U. S. S. R.	40	80	80	40			20	20	20			40
WEST COAST		80	80	40	40	40	20	20	20			

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA						80*	40*	20				
ARGENTINA	20		40	40	40						15	15
AUSTRALIA	15					40	20	20	20			15
CANAL ZONE	20	80	40	40	40	40	20	20	15	15	15	20
ENGLAND	40	40	40	80				20	15	20		40
HAWAII	15	20			40	40	40				15	15
INDIA	15^{1}	20^{1}	20^{1}				40^{1}	20^{1}	20^{1}			
JAPAN						80*	40*	20				
MEXICO	20	80	40	40	40	40	20	20	15	15	15	20
PHILIPPINES								20				
PUERTO RICO	20	80	40	40	40	40	20	20	15	15	15	20
SOUTH AFRICA	20	40*							15	15	20	20
U. S. S. R.	40		40	40				20	20			

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	20			40	40	40	40	40			20
ARGENTINA	15	20		40	40	40	40	40		15	15	15
AUSTRALIA	15	20	20				40	80*	40	15	15	15
CANAL ZONE	20	20		40	40	40			20	15	15	15
ENGLAND			80*	40					20	20		
HAWAII	15	15			20	20	20	20				15
INDIA		20										
JAPAN	15	20			40	40	40	40	40			20
MEXICO	20	20		40	40	40			20	15	15	15
PHILIPPINES	15	20					40	40		20		20
PUERTO RICO	20	20		40	40	40			20	15	15	15
SOUTH AFRICA	20	40^{1}	40^{1}							15	15	20
U. S. S. R.		40^{1}	40^{1}	40^{1}	40^{1}				20	20		
EAST COAST		80	80	40	40	40	20	20	20			

1 = May be open only once or twice during month.
* = Try next higher band.

G = Good, F = Fair, P = Poor.

FEBRUARY

SUN	MON	TUE	WED	THU	FRI	SAT
						1 F
2 G	3 F	4 G	5 F-P	6 P-F	7 F	8 F-P
9 P	10 P	11 P-F	12 F-G	13 G	14 G	15 G
16 G	17 G	18 F-P	19 P	20 P-F	21 F	22 F-P
23 P	24 F	25 G	26 G	27 G	28 G	

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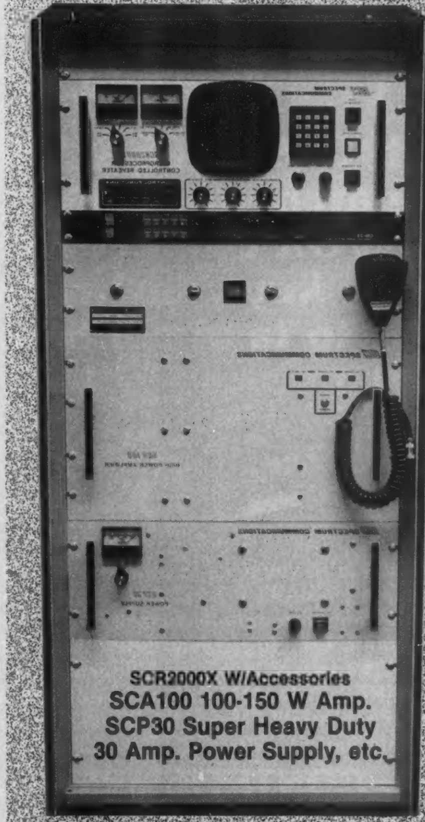
new

In repeaters, there's

NO COMPARISON



For your new or upgraded Repeater/Link System, you won't find a better quality or higher performance machine than the New SCR2000X. This highly advanced unit includes a wide array of DTMF Remote Control Functions, Automatic Digital Controls, and a full complement of front panel local control, test and metering functions. The 2000X is a commercial grade repeater which provides RD performance superior to any competitive unit. And it's built to last—for years and years—by **Spectrum**... the people with over a decade's experience in worldwide repeater/link systems.

STANDARD FEATURES

- Autopatch/Reverse Patch, [illegible] Inhibit
- Dial Pulse Converter
- Autodialer
- Phone line & "over the air" command modes. Virtually all functions may be turned on/off remotely
- Touch-tone Control of Timeout, Hang Time, Patch Timeout, TX Inhibit/Reset, Patch & Reverse Patch, Inhibit, Reset, P.L. On/Off (w/optional P.L. board), etc.
- Up to 6 Auxiliary Functions. More with TRC300
- Full 16 Digit Decoding with Crystal Controlled Decoder IC
- Touch Tone Mute
- Unique Courtesy Tones
- "Kerchunk Killer"
- Timeout Warning Tones
- Automatic CW ID & ID Commands
- Remote Programming of 3 Timers for 2 different timing cycles or No Time Out
- Microprocessor Memory Battery Backup
- Autopatch AGC for constant levels
- Local Status Indication via 12 Function Panel LCD Display
- Front panel Touchtone Pad for Local Control & Phone line access
- Full Panel Metering: Rcvr. & Xmtr. functions plus Voltages & Currents
- New-improved RCVR, UHF Xmtr, Power Supply
- 30-75 Watt VHF & UHF Models
- 100-150 Watt Final Amps Available
- SC200X Microprocessor Controller & Interface Boards also available. Same features as above.

SPECTRUM'S 2000X
microprocessor controlled repeater

"The Repeater of the Future"—Available Today!

FCC Type Accepted for Commercial Service

And that's not all...

We also make—**"Super Monster"**

NEW

150 Wt. 2M & 100W 440 MHz Mobile Amps

- 2M: 30 or 10W In. 440 MHz: 40 or 10W In.
- Unusually massive "deep fin" heatsink allows higher duty than competitive units!
- Many built-in protection features
- Automatic RF Sensing

SCA100M

Rcvr., Xmtr., Control Boards, Duplexors, Antennas, Cabinets, Xcvrs, etc., also available. Amateur & Commercial.

Call or write today for details. Sold Factory Direct through Export Reps. only

SC SPECTRUM COMMUNICATIONS

DEPT. S2•1055 W. GERMANTOWN PIKE•NORRISTOWN, PA 19403•(215) 631-1710•TLX 846-211

What To Look For In A Phone Patch

The best way to decide what patch is right for you is to first decide what a patch should do. A patch should:

- Give complete control to the mobile, allowing full break in operation.
- Not interfere with the normal operation of your base station. It should not require you to connect and disconnect cables (or flip switches!) every time you wish to use your radio as a normal base station.
- Not depend on volume or squelch settings of your radio. It should work the same regardless of what you do with these controls.
- You should be able to hear your base station speaker with the patch installed. Remember, you have a base station because there are mobiles. ONE OF THEM MIGHT NEED HELP.
- The patch should have standard features at no extra cost. These should include programmable toll restrict (dip switches), tone or rotary dialing, programmable patch and activity timers, and front panel indicators of channel and patch status.

ONLY SMART PATCH HAS ALL OF THE ABOVE.

Now Mobile Operators Can Enjoy An Affordable Personal Phone Patch. . .

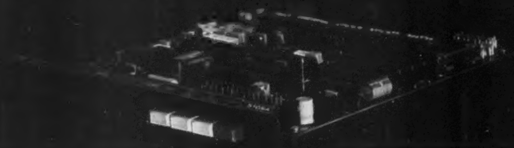
- Without an expensive repeater.
- Using any FM tranceiver as a base station.
- The secret is a SIMPLEX autopatch, The *SMART PATCH.*

SMART PATCH Is Easy To Install

To install *SMART PATCH*, connect the multicolored computer style ribbon cable to mic audio, receiver discriminator, PTT, and power. A modular phone cord is provided for connection to your phone system. Sound simple? ... IT IS!

With SMART PATCH You are in CONTROL

With CES 510SA Simplex Autopatch, there's no waiting for VOX circuits to drop. Simply key your transmitter to take control.



SMART PATCH is all you need to turn your base station into a personal autopatch. SMART PATCH uses the only operating system that gives the mobile complete control. Full break-in capability allows the mobile user to actually interrupt the telephone party. SMART PATCH does not interfere with the normal use of your base station. SMART PATCH works well with any FM transceiver and provides switch selectable tone or rotary dialing, toll restrict, programmable control codes, CW ID and much more.

To Take CONTROL with Smart Patch – Call 800-327-9956 Ext. 101 today.

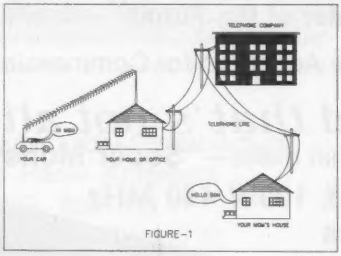


FIGURE-1

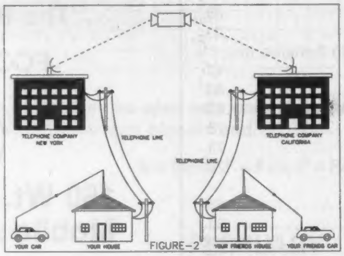


FIGURE-2

Communications Electronics Specialties, Inc.
P.O. Box 2930, Winter Park, Florida 32790
Telephone: (305) 645-0474 **Or call toll-free (800)327-9956**

How To Use *SMART PATCH*

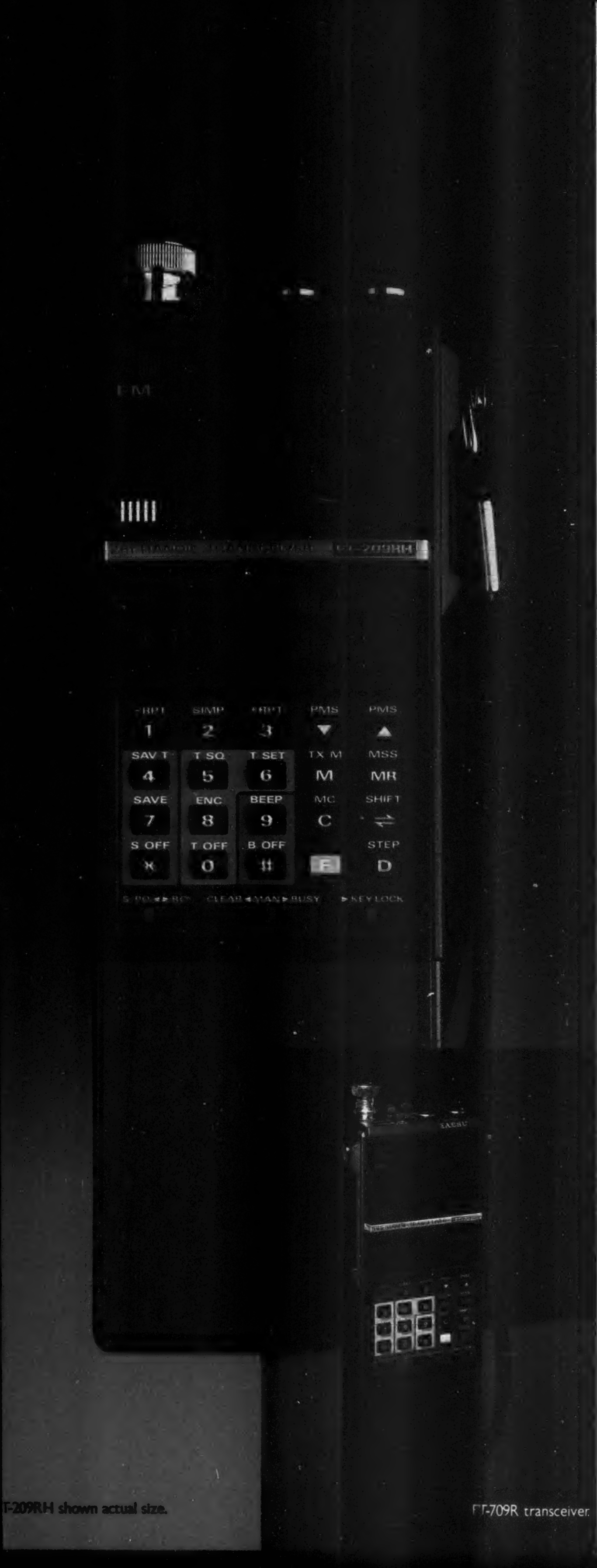
Placing a call is simple. Send your access code from your mobile (example: *73). This brings up the Patch and you will hear dial tone transmitted from your base station. Since *SMART PATCH* is checking about once per second to see if you want to dial, all you have to do is key your transmitter, then dial the phone number. You will now hear the phone ring and someone answer. Since the enhanced control system of *SMART PATCH* is constantly checking to see if you wish to talk, you need to simply key your transmitter and then talk. That's right, you simply key your transmitter to interrupt the phone line. The base station automatically stops transmitting after you key your mic. *SMART PATCH* does not require any special tone equipment to control your base station. It samples very high frequency noise present at your receivers discriminator to determine if a mobile is present. No words or syllables are ever lost.

SMART PATCH Is All You Need To Automatically Patch Your Base Station To Your Phone Line.

Use *SMART PATCH* for:

- Mobile (or remote base) to phone line via Simplex base. (see fig 1.)
- Mobile to Mobile via interconnected base stations for extended range. (see fig. 2.)
- Telephone line to mobile (or remote base).
- *SMART PATCH* uses SIMPLEX BASE STATION EQUIPMENT. Use your ordinary base station. *SMART PATCH* does this without interfering with the normal use of your radio.

WARRANTY?
YES, 180 days of warranty protection. You simply can't go wrong.
An FCC type accepted coupler is available for *SMART PATCH.*



T-209RH shown actual size.

FT-709R transceiver

High power to get you out. Battery saver to keep you there.

Where other HTs don't make it, Yaesu's 2-meter FT-209RH and 440-MHz FT-709R keep going strong. Here's why:

Our 2-meter model offers you 5 watts output. And our 440-MHz model offers 4½ watts.

Yet there's no excessive battery drain, thanks to a unique user-programmable Power Saver. When activated, it puts the rig "to sleep" while monitoring, and "wakes it up" when the squelch breaks. Thus, you can listen for hours while keeping plenty of power in reserve.

And despite the wealth of advanced features, operation is actually simple and intuitive. That's why our radios are so much easier to "learn" than any other advanced HT.

At the push of a button, you can recall the information you've independently stored in each of the ten memories: receive frequency, standard or non-standard offset, even tone encode/decode.

Monitoring your favorite repeaters or simplex frequencies is just as easy. Just touch a button to scan all memory channels, selected ones, or all frequencies between adjacent memories. And use the priority feature to return automatically to a special frequency.

Bring up controlled-access machines with the optional plug-in subaudible tone encoder/decoder, independently programmed from the keyboard for each channel. Then use the decode function to listen for tone-encoded signals on selected channels—without a lot of chatter.

Finally, both HTs cover 10 MHz, and come complete with a 500-mAh battery, charger and soft case. Options include a VOX headset and hard leather case.

So next time you visit your dealer, pick up Yaesu's 2-meter FT-209RH or 440-MHz FT-709R. Because they not only get you out, they keep you there too.

YAESU

Our 30th Anniversary.

Yaesu Electronics Corporation
6851 Walthall Way, Paramount, CA 90723
(213) 633-4007.

Yaesu Cincinnati Service Center
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(513) 874-3100.

Prices and specifications subject to change without notice.

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NEW
Compact 45 W 2 m

45 Affordable Watts!

TM-201B/401B

Super-compact mobile transceivers

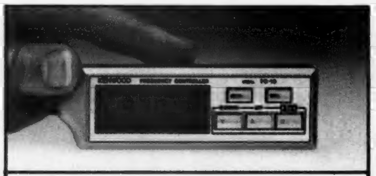
The TM-201B boasts a powerful 45 watts output, easy-to-operate front panel controls, and ultra-compact size. The GaAsFET receiver front end provides high sensitivity and wide dynamic range. Receive and transmit characteristics are tailored for minimum distortion and excellent audio quality. Both the TM-201B and the TM-401B are supplied with a high-quality external speaker, 16-key DTMF microphone and mounting bracket.

5
10
15
10
20
20
40
WATTS
THRULINE®
BIRD ELECTRONIC CO

- 45 watt output, with HI/LO power switch (TM-401B has 25 watts output.) 5 W low.
- Dual digital VFOs
  TM-201B covers 142-149 MHz, includes certain MARS and CAP frequencies
  TM-401B covers 440-450 MHz
- 5 memories plus "COM" channel, with lithium battery back-up
- Programmable, multi-function scanning
- High quality external speaker supplied
- Audible beeper confirms operation

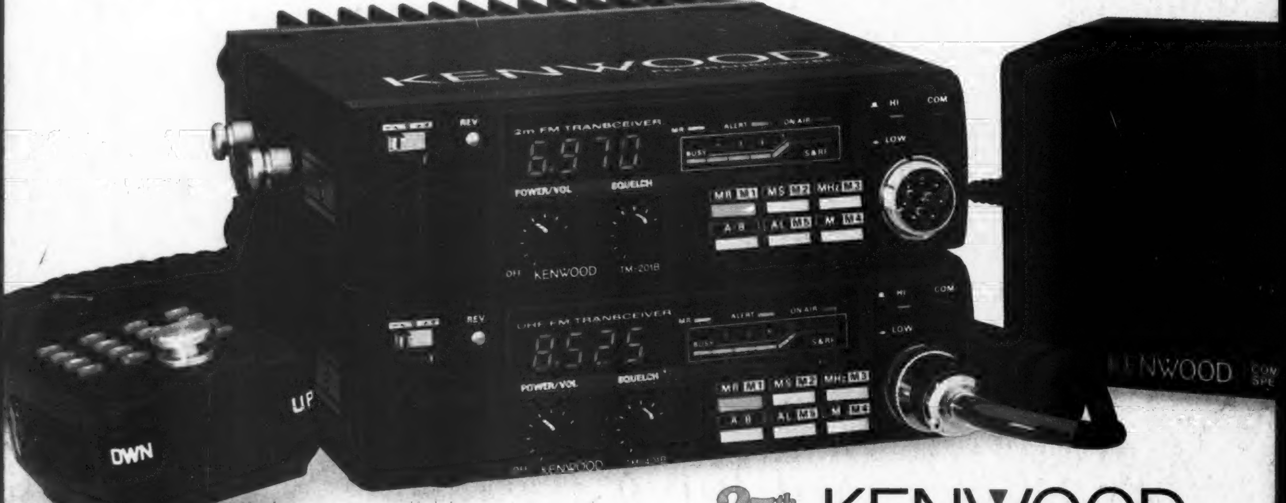
Optional accessories:

- PS-430 power supply
- TU-3 or TU-3A two frequency tone encoder
- FC-10 frequency controller
- MC-55 (8-pin) mobile microphone
- SP-40 compact mobile speaker
- SP-50 deluxe mobile speaker
- SW-100A/B SWR/power meters
- SW-200A/B SWR/power meters
- SWT-1 2 m antenna tuner
- SWT-2 70 cm antenna tuner
- PG-2K extra DC cable
- PG-3A DC line noise filter
- MB-201 extra mobile bracket



Optional FC-10 frequency controller
Convenient control keys for frequency UP/DOWN, MHz shift, VFO A/B, and MR (memory recall or change memory channel).

More information on the TM-201B/401B is available from authorized dealers.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UP
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25th Anniversary

KENWOOD

TM-401B is similar to the TM-201B, but covers 440-450 MHz and is 25 watts.
Specifications and prices subject to change without notice or obligation.
Complete service manuals are available for all Trio-Kenwood transceivers and most accessories.

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Compton, California 90220